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INPUT

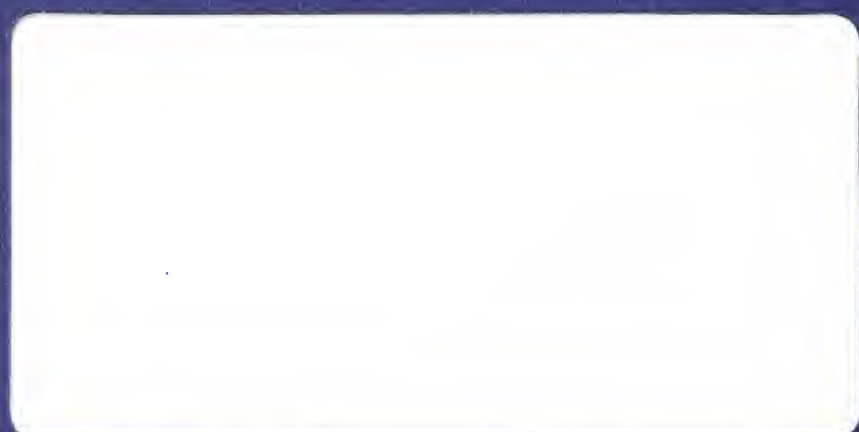## Information Services
Opportunities & Trends, 1994-1999

Process
Manufacturing

U.S. Market Analysis Program

Information Services
Opportunities & Trends, 1994-1999

Process
Manufacturing

October 1994

INPUT®

U.S. Information Services Market Analysis Program

Process Manufacturing

Information Services Opportunities and Trends, 1994-1999 Forecast Update

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Exhibits

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I

Introduction

A
Purpose, Contents and Organization

This section identifies the purpose and scope of this report, notes key issues affecting information services expenditures in the process manufacturing market sector, and explains how the document is organized.

1. Purpose

The purpose of this report is to identify key opportunities and challenges for the users and providers of information services in the process sector of the manufacturing industry. The 1994 INPUT forecast for this sector is included.

2. Contents and Organization

In addition to this introductory chapter, the report contains analyses of the information services market and competitive environment as described below:

- Chapter II, *Trends, Events and Issues*, discusses changes, market issues and activities, and competitive factors in the process manufacturing sector that can have an impact on the current and future use of information systems.

- Chapter III, *Information Systems Environment*, presents an analysis of the information systems environment, noting the impact of applications trends, environmental forces, new technologies and budgets for the U.S. process manufacturing market.

- Chapter IV, *Market Forecast,* presents an analysis of the expenditures for information services, by product/service sector, for the U.S. process manufacturing market.

- Chapter V, *Competitive Environment*, discusses key industry issues and considers the competitive positioning of major vendors. It also identifies significant vendors by size and application area, and offers profiles of a selection of leading vendors.

- Chapter VI, *User Buying Patterns,* presents near-term and long-range plans to implement new applications.

- Chapter VII, *Conclusions and Recommendations*, offers suggestions and recommendations for participants in the process manufacturing market.

- Appendix A, which contains the forecast database, presents a detailed forecast by product and service for the process manufacturing vertical market.

- Appendix B presents a reconciliation for 1993 and 1998 market values from this report and the 1993-1998 process manufacturing forecast.

- Appendix C defines the structure of the process manufacturing industry, describes INPUT's research methodology, and lists related INPUT reports.

B
Executive Summary

Total quality management (TQM) practices and global competitiveness continue to cause distinctions between discrete and process definitions to blur. The concepts of continuous flow, flexible manufacturing, process control, 100% quality, 100% service, reduced cycle times, and increased customer responsiveness require that managers blend the best of process and discrete manufacturing practices. The implementation of these concepts indicates an increased use of automation and information services in the market. It also predicts a redirection of the marketing, development, and delivery practices for the

vendors of such services. Note here that TQM measures *all* activities in a company in terms of a "process" environment.

1. Key Trends and Issues

Key trends and issues influencing the use of information services are noted below:

- The implementation of TQM principles and computer-integrated-manufacturing (CIM) elements is bringing about a new company structure, often referred to as business re-engineering. The portions of that change referred to in this report are:

    - Cellular structure and the team approach to continuous improvement

    - Separation of the planning, execution, and control functions, as those activities apply to achieving TQM objectives

    - Outsourcing and building vendor relationships, both in information services delivery and partnering for manufacturing operations and the purchase of services and materials

    - The use of computers and information services to promote the attainment of company goals, and the importance of new technologies as they apply to achieving the sought-after results

- The process manufacturing sector is being influenced by conflicting forces:

    - Foreign competition and new markets

    - Global needs and concerns about easier communication

    - Spillover from the 1980s' merger and acquisition activity

    - The dramatic decrease in product life cycles

- The need to run lean operations, yet be more customer-responsive

- Growth and its attendant investment versus profitability

- All but the oil and petroleum industries are predicted to grow at a comfortable rate through the forecast period, and personnel growth is projected to grow at a slower rate than revenues.

- Profitability has returned for most companies, but there is still some uncertainty due to large-company problems and restructuring costs.

- Inflation has definitely slowed and interest rates remain low, but taxes are increasing.

- The regulatory environment will continue to be a major issue to most process industries. De facto self-regulation is appearing in the form of ISO-9000 certification as many U.S. manufacturers adopt the European quality standards.

- The proven new business practices inherent in TQM and CIM offer significant opportunities to companies in this marketplace. The two elements necessary to achieve continuous improvement—tools and training—are available, but it is not clear if they are they fully understood or if businesses will invest fast enough to reap the benefits.

- There is a recognized need for immediate, accurate, integrated information availability. Networks, distributed computing, open systems, and relational databases offer those qualities at a reasonable return-on-investment basis. Is the knowledge available to take advantage of these resources?

- Downsizing, particularly to client/server systems, continues to be a particularly strong trend in this sector.

- Software vendors and systems integrators are scrambling to migrate their offerings to client/server and open systems technologies, which are necessary to compete in the current environment.

2. Information Services Market

The market for information services in the process manufacturing sector is expected to continue to have healthy growth through 1999. Total expenditures for information services is forecast at almost $8.4 billion in 1994 (a 13% growth over 1993), expanding to $16.4 billion in 1999, for a compound annual growth rate (CAGR) of 15%.

The re-engineering of business processes is driving demand for information services in this sector. As companies restructure, the IS function within a manufacturing company must respond with new techniques for providing immediate and accurate decision-making information. The move to client/server environments is compatible with this new structure.

Strong competition among information service providers is aiding growth in the IS market. The market remains fragmented, with no single vendor dominating a category. At the same time, specialized vendors are entering the market and carving out their own niches.

Exhibit I-1 shows INPUT's forecast of expenditures and growth rates for each product and service category.

Professional Services represents the largest category of information services expenditures. At over $2.5 billion in 1993, and growing at 15% throughout the forecast period to almost $5.9 billion, it represents a substantial opportunity. INPUT expects IS consulting and software development to grow steadily, and education and training to accelerate slightly as manufacturers continue internal education efforts for new technologies such as client/server.

Network Services growth is a reflection of the growing importance of sophisticated telecommunications in this sector. EDI, the growing recognition of electronic commerce, and electronic filing of government reports are important facilitators.

Outsourcing is divided into platform, applications, desktop services, and network management. Growth in this area is forecast at a 17% CAGR through 1999, from $954 million in 1993 to almost $2.5 billion in 1999.

Applications Software, though growing at an 18% rate, has not enjoyed the same success in the process manufacturing sector as it has in discrete manufacturing.

Processing Services, at 3%, continues to be the slowest-growing product/service category in the information services market, losing ground to more aggressive approaches tailored specifically to meet customer needs.

Turnkey Systems is expected to grow at 10%, fueled by the demand for applications software and professional services.

Systems Integration will grow at a CAGR of 15% during the forecast period as a result of increased demand for single-source responsibility on major IT projects. The professional services component of SI will grow the fastest.

Exhibit I-1

Process Manufacturing
1994-1999 Market Forecast

Products and Services	1994 ($M)	1999 ($M)	CAGR 94-99 (%)
Sector Total	8,356	16,447	15
Professional Services	2,936	5,856	15
Network Services	1,281	2,780	17
Outsourcing	1,107	2,456	17
Applications Software	942	2,114	18
Processing Services	817	960	3
Turnkey Systems	768	1,262	10
Systems Integration	505	1,019	15

3. Conclusions and Recommendations

Vendors who wish to achieve significant revenues in the process manufacturing sector should do the following:

- Target narrow market segments.

- Develop industry expertise and invest in industry training.

- Develop alliances with niche vendors, and invest in improving their own products rather than re-inventing a successful offering.

- Develop a sales approach that emphasizes the critical business needs of the customer, rather than the features of the product.

- Train sales people to sell value, not price.

- Understand the concepts of business re-engineering, total quality management, and value-added integration.

- Establish formal programs to ensure quality in both product and customer service and support.

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II
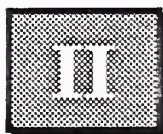
Trends, Events and Issues

This chapter presents the significant trends, events and issues affecting process manufacturers in the U.S. The conditions explored include the economy, the competitive picture, and the current business practices of re-structuring/re-engineering and implementation of total quality management (TQM) principles.

As companies in the market continue to restructure, they are making greater use of available technology from information services (IS) vendors. Additionally, TQM implementation requires increases in automation, improved workflow, and immediate information movement and availability. The latter part of the chapter discusses recent trends and improvements in information technology offerings.

A
General Business Trends and Events

In retrospect, 1993 was a very good year for the U.S. economy. The recession that halted in 1992 generated a slow recovery in 1993, and the pace of recovery should now accelerate as the pent-up demand for consumer products is satisfied by new production. In addition, the U.S. auto industry, the largest component of the economy, continued it's strong competitive performance against foreign manufacturers. Industrial demand has also been on hold for the last few years, as fiscal caution forced conservative spending patterns for industrial goods and services, including information services. Now with the country back on a slow but steady growth path, INPUT believes that spending by process manufacturers for information services will continue on the healthy path forecast in INPUT's 1993 *Process Manufacturing Sector* report.

According to the Department of Commerce's 1994 edition of the *U.S. Industrial Outlook*, American industry is healthy and growing at a moderate pace. Exhibit II-1 summarizes growth in revenues for process manufacturing industries. Key points to emphasize are:

- Overall growth in the process manufacturing sector will keep pace with the growth of the U.S. economy in 1994.

- The basic industries of mining and crude petroleum and natural gas will grow faster than other industries in this sector.

Exhibit II-1

1994 Industrial Growth

Industrial Grouping	1993 Revenue ($ Billions)	1994 Revenue ($ Billions)	'93-'94 Growth (%)
Metals/Industrial Materials Mining	32.2	32.7	1.7
Coal Mining	21.0	22.1	5.0
Crude Petroleum/Natural Gas	81.1	85.8	5.4
Petroleum Refining	147.5	153.6	4.0
Lumber and Wood Products	47.3	48.4	1.9
Textiles	137.6	139.7	1.5
Paper and Allied Products	229.2	238.5	3.9
Chemicals and Allied Products	488.8	502.0	2.6
Food and Food Products	808.7	830.8	2.7
Totals	1,993.4	2,053.6	3.0

Source: U.S. Industrial Outlook, 1994

B
Specific Industry Trends, Events and Issues

The overriding trend in process manufacturing companies is toward delivering excellent products and/or services on a timely basis, at a competitive price, and assuring 100% customer satisfaction. The approach mandates responsiveness to individual customers as well as to the market as a whole, and

while adoption of the principles has been proven to be highly beneficial, the actual implementation has been slow.

Progress has been difficult because manufacturers have had to re-engineer their business processes while implementing TQM. Companies and/or industries that began the implementation of the new concepts early are now reaping the rewards.

Initially, companies in the process sector began to re-engineer their business practices in order to fight foreign competition. Ultimately, they achieved more—they found themselves in "market leader" positions, and now other companies are joining the march toward "excellence."

The new principles are proven, and they are being implemented. For the buyers and sellers of information services, this is an extremely important trend. At the heart of TQM is the use of automation and totally integrated information that is available immediately. Because of the new concepts, computer-integrated manufacturing (CIM) has become a reality in many companies. As workers become empowered they are not only allowed to make decisions, they *must* make decisions. Immediate, complete and accurate information is required at all levels for decision making to be effective.

1. Re-engineering the Manufacturing Company

Restructuring is continuing on a large scale throughout process manufacturing companies. Although it has many elements, the major factors are listed below:

- Team assignments to perform complete operations, typically called "focused cells"

- Worker empowerment, moving decisions to the lowest level possible

- Continuous improvement in terms of

    - shortening all cycles in business operations

- work toward achieving 100% acceptable quality in all processes and products

- 100% customer satisfaction

• Responsiveness to total market needs and individual customer needs

• Streamlining to focus on a company's area of expertise

As shown in the 1993 report, the use of cellular concepts in manufacturing has brought positive change to the work environment. The old hierarchical structure is noted in Exhibit II-2. However, the old structure has given way to a new way of conducting business activity, as shown in Exhibit II-3.

The new cellular structure leads to worker empowerment and accountability. With quality and service as the key watchwords, the ability to react must reside at the point of opportunity or problem.

As worker involvement and the team approach succeed, real benefits to companies are becoming evident in terms of continuous improvement. For instance:

• Product life cycles are shortening dramatically, and time to market for new products is keeping pace with the change. Most process companies are including plant engineering personnel in the product development teams to assure earlier delivery of new products.

• Order-receipt-to-shipping cycles have contracted rapidly. Large buyers and marketers are demanding the use of electronic data interchange (EDI) for ordering, acknowledgments and delivery schedules. Line-fill rates and hard delivery dates are increasingly common in purchase orders, particularly in consumer nondurables. Aside from better customer service, these improvements also offer financial benefits in terms of lower inventories and fewer returns.

Exhibit II-2

Old Hierarchical Structure

Corporate Management

CEO
CFO
COO
VP Engineering, Sales, Marketing, Human Resources

Corporate sales staff — Corporate control — Corporate engineering staff

Customer service — Product sales staff — Plant staff management — Plant engineering — Plant control

Line management, all products

Receive, test — Produce — Store, inventory control — Ship — Report
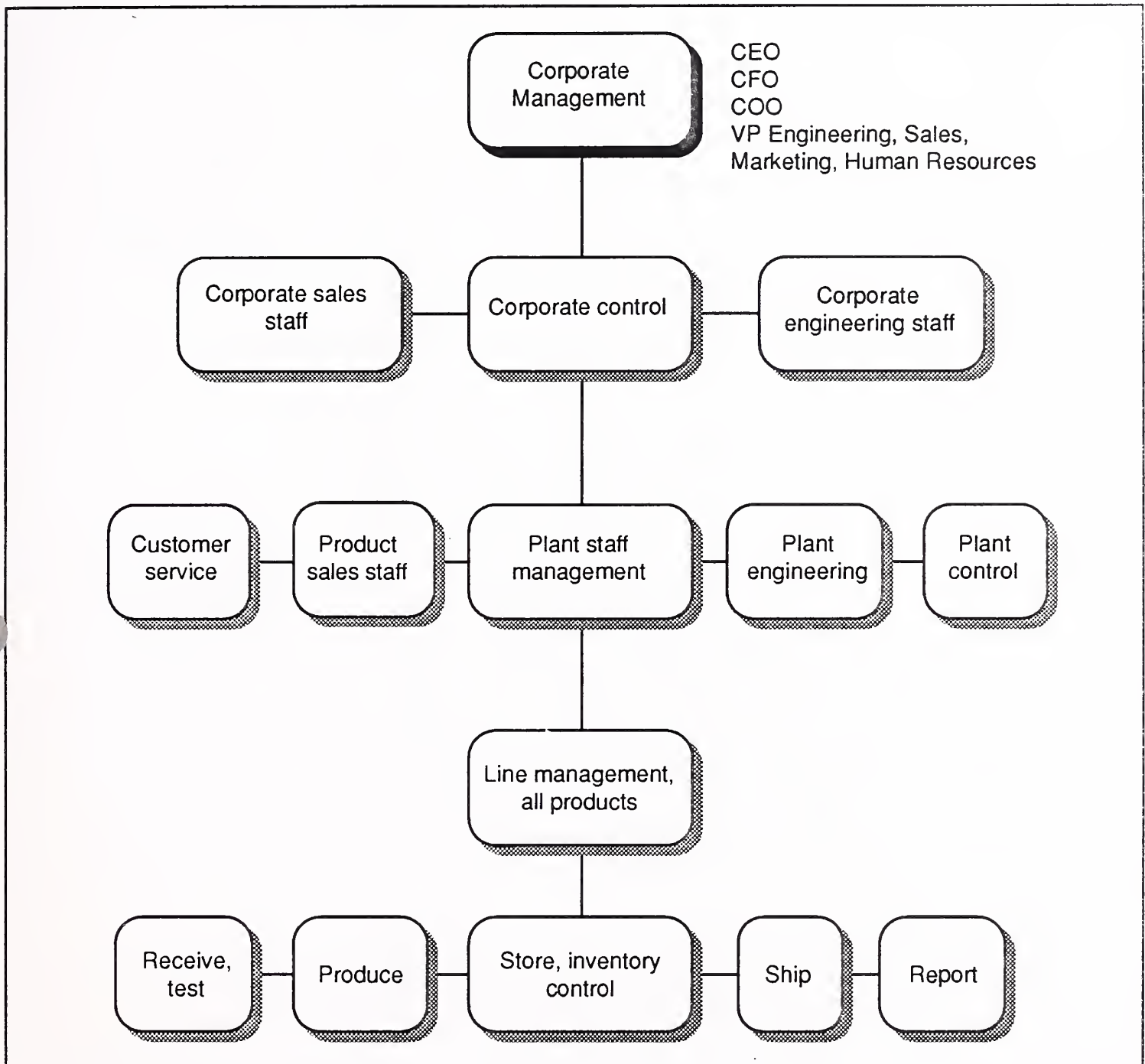
Exhibit II-3

Re-engineered Structure

Corporate
Management

Sales

Corporate
control

Logistics,
traffic

Focused
cells (FC)

CWICs*

Plant
management

FC
Purchase,
manufacture, quality
control schedule,
etc.

Customer
service

All functions are responsible individually and collectively for
"customer service" levels of 100%. A customer can be either
internal or external

*CWIC is "cells within a cell," where workload and diversity of
assignments may call for further quality control and responsibility

Each focused cell has total responsibility for the completion of its
operation.

- Quality improvement is often dramatic. Scrap is being reduced from the 3%-5% range to less than 0.5%. This is particularly important in the process industries, where raw materials usually cannot be recovered for reuse.

- The cycle reductions and improved quality lead to higher customer satisfaction at the time of sale. The use of computers and automation to track production lots enables the manufacturer to provide better and quicker service after the sale, as well. Also, many of the process industries, such as foods, beverages, pharmaceuticals and chemicals, are *required* by statute to track and maintain production lots.

- The improvements lead automatically toward satisfying total market and individual customer needs. Automation is aiding in this pursuit through the electronic interchange of data and through advanced network services, giving businesses a quick reaction capability.

As the restructuring has begun, a new phenomenon has occurred. Businesses have been able to streamline (or downsize) with a positive effect on overall performance. Operations that don't fit a company's normal practices are often outsourced. Product lines are sold to implement more tightly focused corporate strategies. Professional services are contracted out rather than adding internal personnel. Middle management jobs are being eliminated. There are numerous reasons for all this:

- In the past, heavy taxes and high profitability made an employee's cost appear to be lower. With lower profits, extremely high benefits costs, and lower tax rates, the picture has changed.

- The acquisition activities of the 1980s left many companies with too many diverse businesses, too much duplicated overhead, and heavy debt burdens (often causing losses simply due to interest charges). Streamlining and downsizing became necessary for survival.

- The commodity nature and low margins of most process products now mandate an ability to operate within the lowest possible cost structure. Most process businesses

require heavy capital investment to enter a particular market. The key is to protect that investment and deter further market entrants.

These re-engineering projects are leading to a re-emergence of the importance of computer-integrated-manufacturing (CIM). The original attempts at implementing CIM were restricted to making computers talk to one another. Information today must support the re-engineered business call for true "information"-integrated manufacturing and service. Current technology for networking (local-area networks and client/server approaches), operating systems standards, and relational databases are bringing true CIM closer to reality.

2. Regulatory Issues and Events

Almost all of the segments in process manufacturing are heavily affected by regulatory requirements. A variety of regulatory issues are involved, as shown in Exhibit II-4.

Exhibit II-4

Regulatory Issues

Industry	Regulation
Chemical/Petroleum/Paper	EPA/Green Movement
Food/Beverage	FDA/NLEA 1990
Pharmaceutical	FDA/Electronic Filing

These industries in particular are affected by environmental regulations and the green movement. New regulatory requirements are constantly being introduced and modified. In the chemical industry, regulations support "right to know" requirements that provide information to the public. Material Safety Data Sheets (MSDSs) are required to provide information on every product for hazardous materials tracking. Companies face hefty fines if they are found to be out of compliance, so regulatory issues become a critical part of running these businesses. Much of the regulation relates to process safety measures that describe how to manufacture, how to train staff and other safety-oriented concerns. Most process companies face constant EPA oversight on emissions into air, water or human bodies.

For the food industry, different regulatory requirements and agencies are involved. A requirement of significant impact to this industry is the Food Labeling Law, introduced by the FDA and referred to as the Nutrition Labeling and Education Act (NLEA). Compliance with this regulation, which went into effect in 1994, is expected to cost the food industry $250 million to $350 million. There is concern that an overload on the FDA review process will result in a slowdown in getting products reviewed and a consequent delay in getting new products to market.

Many process manufacturers and information services vendors cited ISO-9000 as a key regulatory issue that will impact their ability to compete internationally. ISO-9000 will require companies that want to do business in Europe to obtain vendor certification. This will require detailed documentation of internal business processes. European customers will establish partnering arrangements and do business only with certified vendors.

Clearly, regulation can be a barrier to both global and domestic competition. This applies not only to the restrictions placed on companies by regulations, but also to the documentation required by government entities to provide proof of compliance. Advances in information technology at the PC/workstation level have allowed chemical companies to track waste and maintain Material Safety Data (MSD) documentation. Electronic filing to the federal government in the pharmaceutical industry will require companies to provide needed information on line. The intent of this is to speed the approval process, allowing new drugs to be available for public consumption sooner. In the food industry, labeling software allows companies to rough out ingredients in new products and track changes, thereby reducing the need for chemical analysis. Streamlining the paperwork associated with regulation will allow companies to be more competitive and speed up the process of introducing new products. The levels of performance required to meet expectations will force more and more companies to re-engineer and incorporate more TQM principles, leading to greater use of automation and CIM techniques.

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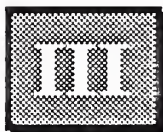
Information Systems Environment

A
Information Systems Issues

As manufacturers re-engineer their businesses away from the hierarchical model to focused cells (see chapter 2), they must move the manufacturing information systems away from centralized mainframes, toward work group-oriented systems and client/server architectures.

Exhibit III-1 shows responses to survey questions regarding key issues facing information systems organizations in the process manufacturing industry.

The data was coded into categories for analytical purposes, and a brief explanation of each category follows.

- *Migration to C/S* - Planning for, implementing or downsizing to client/server technology

- *Network Integration* - Network integration itself or the integration of applications across distributed networks

- *Responsiveness* - The ability of the systems environment to respond to changing application needs and end-user management requirements

- *Cost Reduction* - Downsizing or distribution of existing staff or general budget reductions within the information systems function

- *Skills Improvement* - "Re-tooling" in-house staff to deal with changing skill requirements brought on by new technology

- *Downsizing* - The need to deal with general downsizing of organizational structures in terms of the impact on systems

- *Standardization* - Improved connectivity, the portability of applications across multiple platforms and the adoption of common standards for workstation/PC and network interfaces

- *Systems Upgrades* - The need to upgrade existing systems to handle new requirements or increased capacity

Exhibit III-1

Process Manufacturing

Major Information Systems Issues
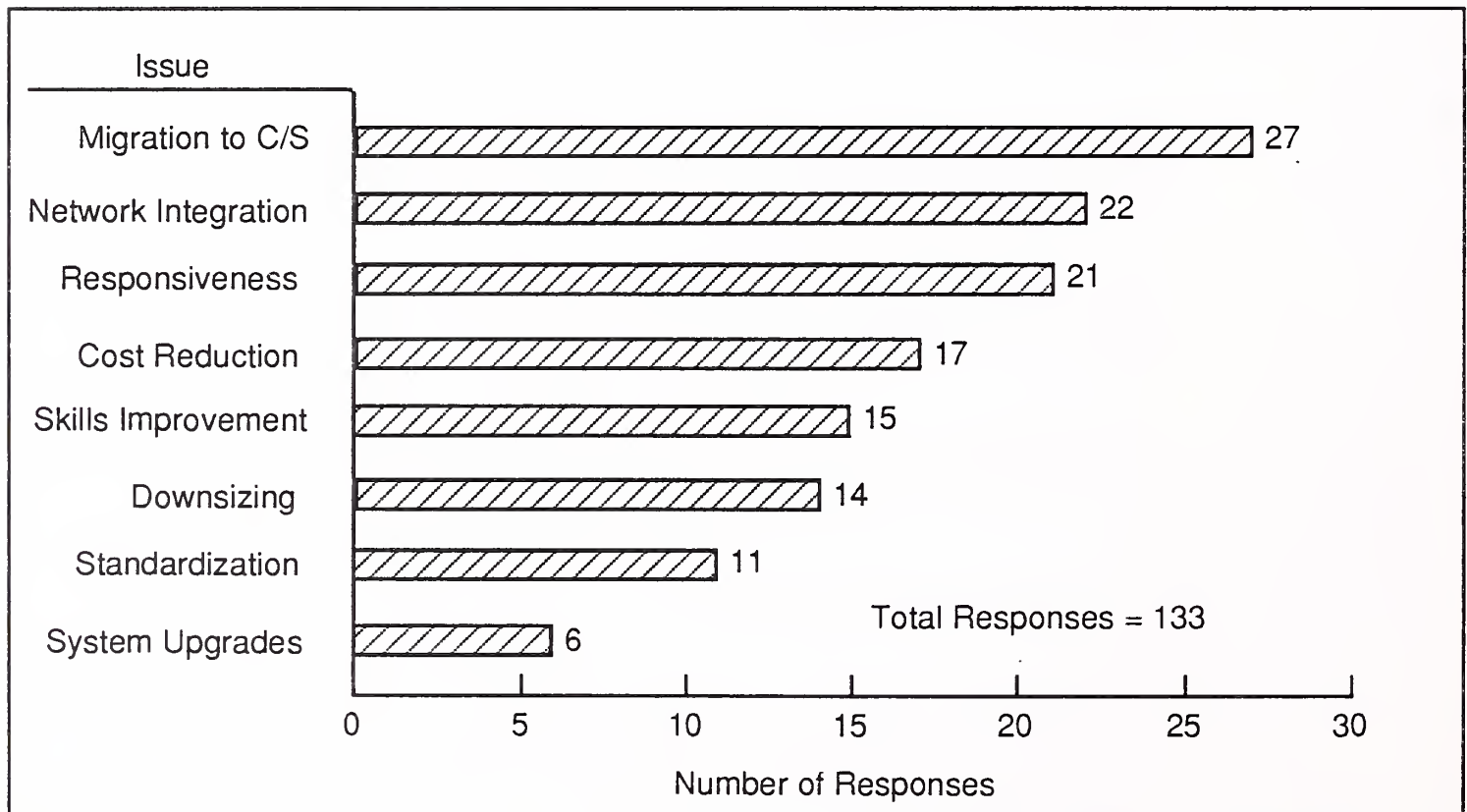
Client/server and network integration issues top the concerns of respondents, accounting for nearly half of all responses. This reflects the movement of manufacturing information systems away from centralized mainframes, toward work group-oriented

systems and client/server architectures, as well as the
distribution of applications and data across the organization.

B
IS Applications Environment

Exhibit III-2 shows responses to key process manufacturing
industry survey questions regarding planned applications, by
application category.

An explanation of the column headings follows:

- "Number of Applications" is the total number of
  applications for each of the application categories.

- The "Strategy" heading contains two subheadings,
  "Client/Server" and "Downsizing." The "Client/Server"
  count by category indicates the number of applications
  within the category that will be implemented using a C/S
  architecture. The count under the heading "Downsizing"
  represents the number of client/server applications (of the
  total that are being implemented) that are part of a general
  downsizing strategy.

- The "Platform" heading indicates the number of times that
  one of the three major platform classes was mentioned as
  the key implementation platform. More than one response
  per application was permitted.

- The "Resources" heading covers six potential sources of
  resources that will be employed as part of the
  implementation process. As was the case with the question
  regarding platform, more than one response per
  application was permitted.

Exhibit III-2

Planned Applications in Process Manufacturing

Application Category	No. of Appls.	Strategy		Platform			Resources						EDI	Out-sour-ced
		C/S	Down-sizing	CS/LAN	Mini com-puter	Main-frame	Corp. IS	Div. IS	User Staff	Sys. Integ-rators	Other Out-side Svcs.	Pack-aged Soft-ware		
Financial	81	32	28	21	29	18	21	26	21	1	17	32	37	11
Manufacturing	76	34	29	26	15	29	20	39	31	2	5	17	24	7
Sales/Marketing	41	23	16	21	4	13	11	25	18	1	1	3	26	1
Infrastructure	28	16	5	15	4	7	8	16	8	0	2	5	12	2
Inventory	26	9	8	7	5	13	10	15	13	0	3	1	9	1
Purchasing	13	6	3	4	5	3	1	8	7	1	3	1	6	0
Engineering	9	2	1	2	0	4	1	2	6	0	2	2	3	1
Database	8	2	1	2	1	5	3	6	3	0	2	1	3	2
Logistics	5	4	2	3	0	2	2	3	4	0	0	1	0	0
Personnel	2	2	2	2	0	0	1	2	1	0	0	1	0	0
All Applications	289	130	95	103	63	94	78	142	112	5	35	64	120	25
Percent	100	45	33	36	22	33	27	49	39	2	12	22	42	9

- Finally, for each application, respondents were asked to indicate whether the application would use EDI or be outsourced. The last two columns give a tabulation of those responses.

A number of observations can be drawn from analyzing the summary data:

- The corporate information systems function in process manufacturing companies is involved in fewer applications (27%) than in discrete manufacturing.

- Just under half (45%) of the 289 applications identified in the survey, are planning to use some sort of client/server architecture.

- Forty-two percent (42%) of the applications will utilize EDI (electronic data interchange) in some form, indicating importance of supply chain management in this sector.

- Packaged software is planned for 22% of all applications. This percentage is lower than in other industries, notably discrete manufacturing, where 36% of new applications will be implemented using packaged software. The relatively low use of packaged applications software reflects the fact that there are generally fewer off-the-shelf applications available for process manufacturing than there are for discrete. It also reflects the tight integration in this sector between information systems and the actual manufacturing process; such integration tends to favor custom applications.

C
IS Response to Environmental Forces

Only 35% of all process manufacturing firms in INPUT's survey plan to use outside resources to implement new applications, as compared to 60% of discrete manufacturing firms. As shown in Exhibit III-3, packaged software is the most frequently used outside resource in this sector, and is planned for 64 of the 289 applications in the survey.

Other outside resources, mostly professional services, are planned for 35 applications, and systems integrators will be used on five projects. The use of systems integrators indicated in the survey is lower than anticipated.

Process Manufacturing

Use of Outside Products and Services

Packaged Software — 64

Other Outside Svcs. — 35

Systems Integrators — 5

Total Mentions = 104

Number of Responses
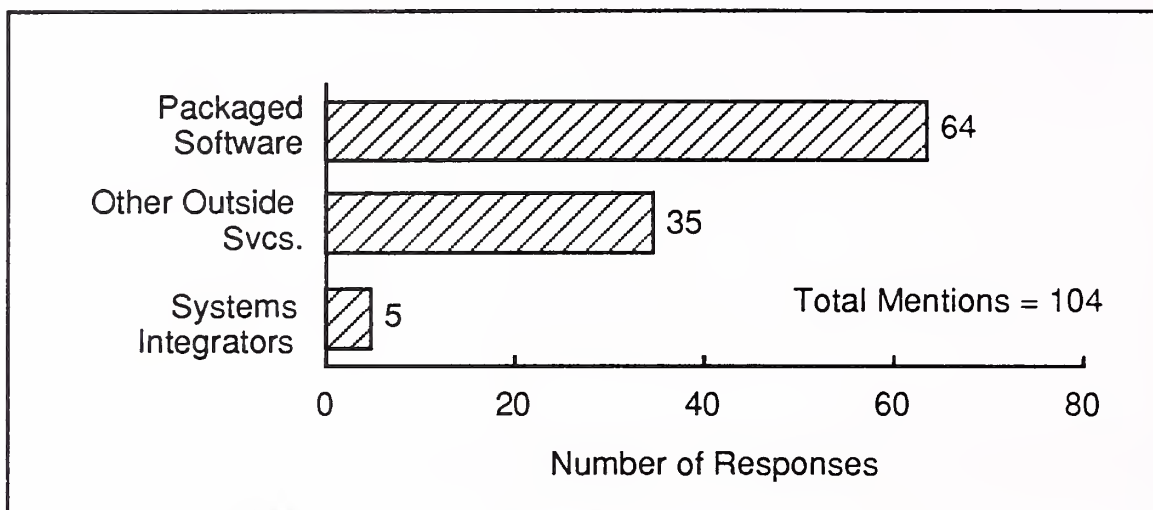
Exhibit III-4 shows that the corporate information systems function is involved in 78 of the 289 applications (27%) in the process manufacturing survey. This is much lower than in other industries—in discrete manufacturing, for example, corporate IS will provide resources on 39% of the projects. Only 11% of all planned applications in the survey will be implemented by corporate IS personnel exclusively, without the involvement of user staff—again, lower than INPUT finds in other industries. These statistics support INPUT's belief that the process manufacturing sector is further along in the decentralization of applications than are many other industries.

There is a strong move to client/server architectures in this sector, with 45% of new applications planned using this approach. In INPUT's view, the move to client/server computing is a long-term trend in process manufacturing, driven by the continuous restructuring discussed in Chapter 2.

Process Manufacturing
Internal Development Resources
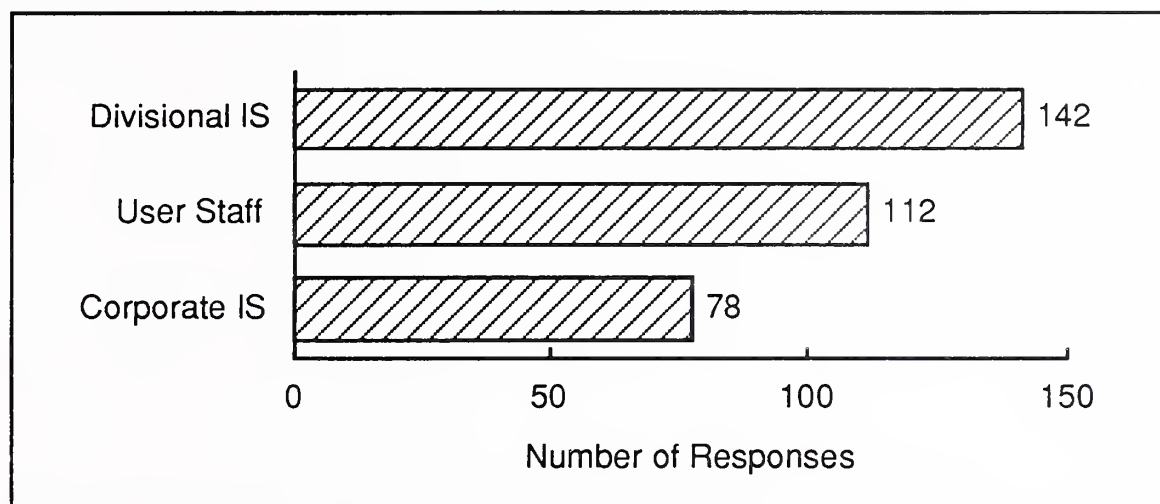
Impact of New Technologies

As discussed in Chapter 2 of this report, the focus on business process re-engineering and TQM have increased emphasis on connectivity, interoperability, and open systems. UNIX has long been accepted in the manufacturing environment. The trend began in engineering departments, and as workstations improved and UNIX matured, entire plants have embraced the standard.

During the late 1980s and early 1990s, important strides were made in data collection and data movement activities:

- Bar code technology improved and has been adopted in nearly all manufacturing environments. A 1988 study of 1,500 manufacturers by Hitchcock Publishing showed the adoption of bar coding to be the number-one IS activity at that time. Not one respondent (of over 400) in INPUT's 1993 survey mentioned bar coding implementation as a new activity. In fact, laser scanners and handheld readers were being used in over 50 plants studied in a 1992 analysis in which INPUT staff participated.

- Programmable logic controllers (PLCs) have improved and are being used in new ways. PLCs are now being delivered with embedded computers that contribute to total quality management performance. For instance, in addition to loading programs and controlling machinery, the PLCs now transmit and receive information from shared RDBMSs. They are also being used as data collection devices for immediate information availability and are the primary source for statistical process control (SPC) for quality.

- Electronic data interchange (EDI), begun in the early 1980s by the automotive industry, has become increasingly common in the manufacturing systems environment. This is especially true in process manufacturing, where orders and shipments can contain many items, many delivery dates and many delivery points. EDI capabilities are moving far beyond the initial stage of simple order transmission. Manufacturers are now working on complete information exchange, including orders, acknowledgments, shipment acknowledgment, invoicing, and even production schedules. Although most companies have some EDI in place, INPUT expects the steady pace of new developments to continue.

All the vendors of applications software interviewed for this report agreed that object-oriented programming (OOP) is the wave of the future and an important step in working toward open systems. Very few vendors, and none of the users interviewed, are currently engaged in any OOP-based product development. INPUT believes that the general availability of such products in this market is five years away.

An important development in manufacturing is the appearance of "cell controllers" and "application enablers." As TQM principles are implemented, statistical process control (SPC) becomes a necessity. The numerous devices and computers present (most machines are now delivered with embedded computers) must be connected in order to share data. Until the late 1980s, the integration of those devices was done on a customized basis. Several companies have now developed standard device "drivers" or "servers" that recognize disparate protocols and enable equipment and software to "interoperate." For example, bar code

readers, CNC machines, PLCs, and computers can converse in what appears to be a common language, without custom integration efforts.

E
Organization and Budget

INPUT asked those surveyed to indicate how much they planned to invest in applications; i.e., software and other information services. As shown in Exhibit III-5, almost half of the projects planned in process manufacturing have an applications budget of over $1 million.

Exhibit III-5

Process Manufacturing

Planned Investment in Applications

$5M to 10M
9%

Over $10M
7%

Under $100K
11%

$100K to 500K
19%

$1M to 5M
32%

$500K to 1M
22%

Total = 205 Applications
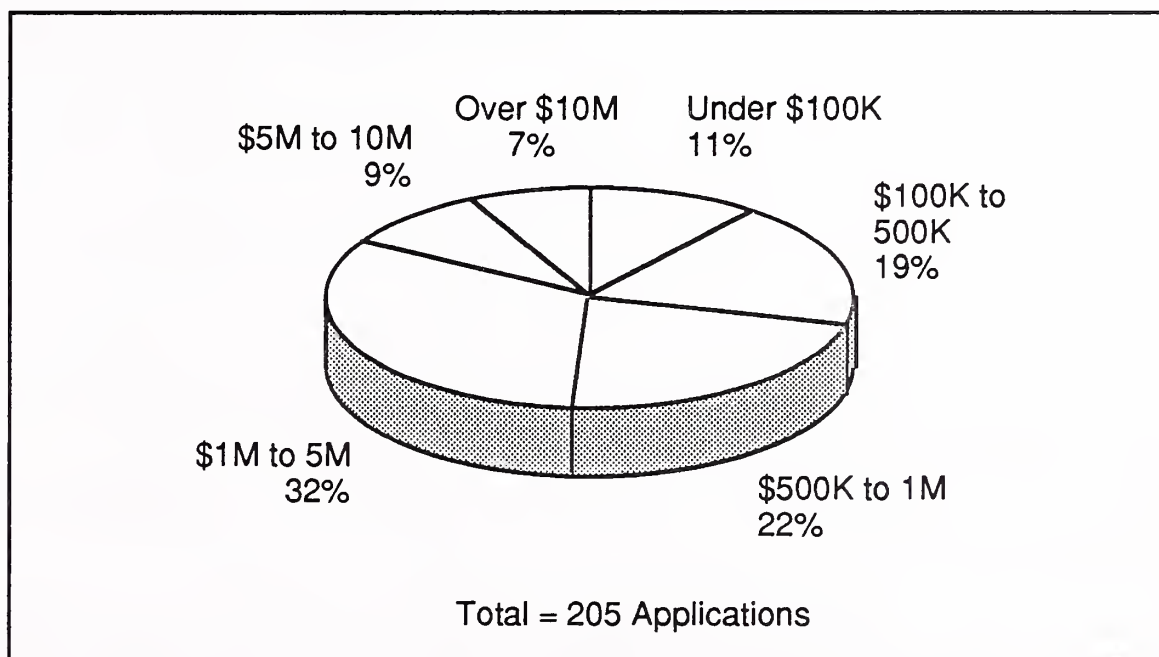
As one might expect, the big projects tend to be in big companies. Sixty-nine percent (69%) of the companies with sales of $1 billion and more planned projects budgeted at over $1 million, whereas only 43% of the smaller companies planned expenditures of this size. Exhibit III-6 shows planned investment by company size.

Exhibit III-6

Process Manufacturing

Planned Investment by Company Size
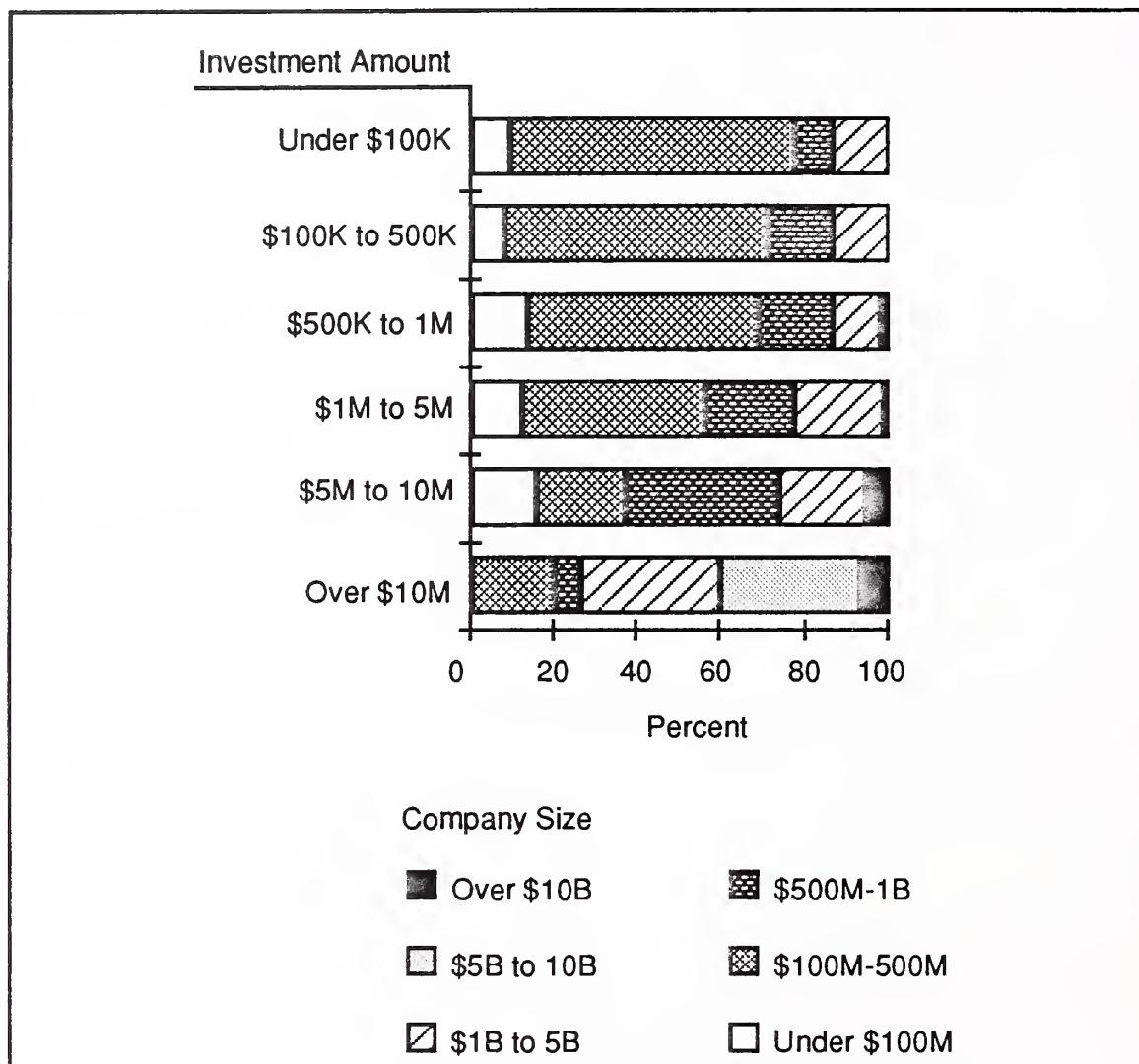
INPUT asked those surveyed to indicate the change in budgets for information systems projects (including hardware, software, people and networks) versus the change in budgets for applications, i.e., software and other information services. On average, respondents indicated that spending on applications would increase by 9.6% in the next year. As shown in Exhibit III-7, purchasing applications will grow the fastest at 21%, followed by personnel and manufacturing applications.

Though users in this sector plan to increase spending on financial systems, non-services investment will grow about twice as fast as investment in software and other information services. This difference is even more pronounced in logistics systems.

In all other categories, spending on software and services will grow faster than spending on hardware and other non-IS items.

Exhibit III-7

Process Manufacturing

Percent Change in Budgets

Application Category

Purchasing	21.1 / 12.9
Personnel	18.5 / 10.5
Manufacturing	10.1 / 8.3
Sales & Marketing	9.4 / 5.6
Inventory	7.9 / 4.5
Financial	7.4 / 15.7
Engineering	6.8 / 4.9
Infrastructure	5.8 / 2.7
Logistics	4.3 / 11.2
Database	3.6 / 2.2

Legend:
- Applications
- All Info. Systems

X-axis: 0.0 5.0 10.0 15.0 20.0 25.0

Change in Budgets (Percent)
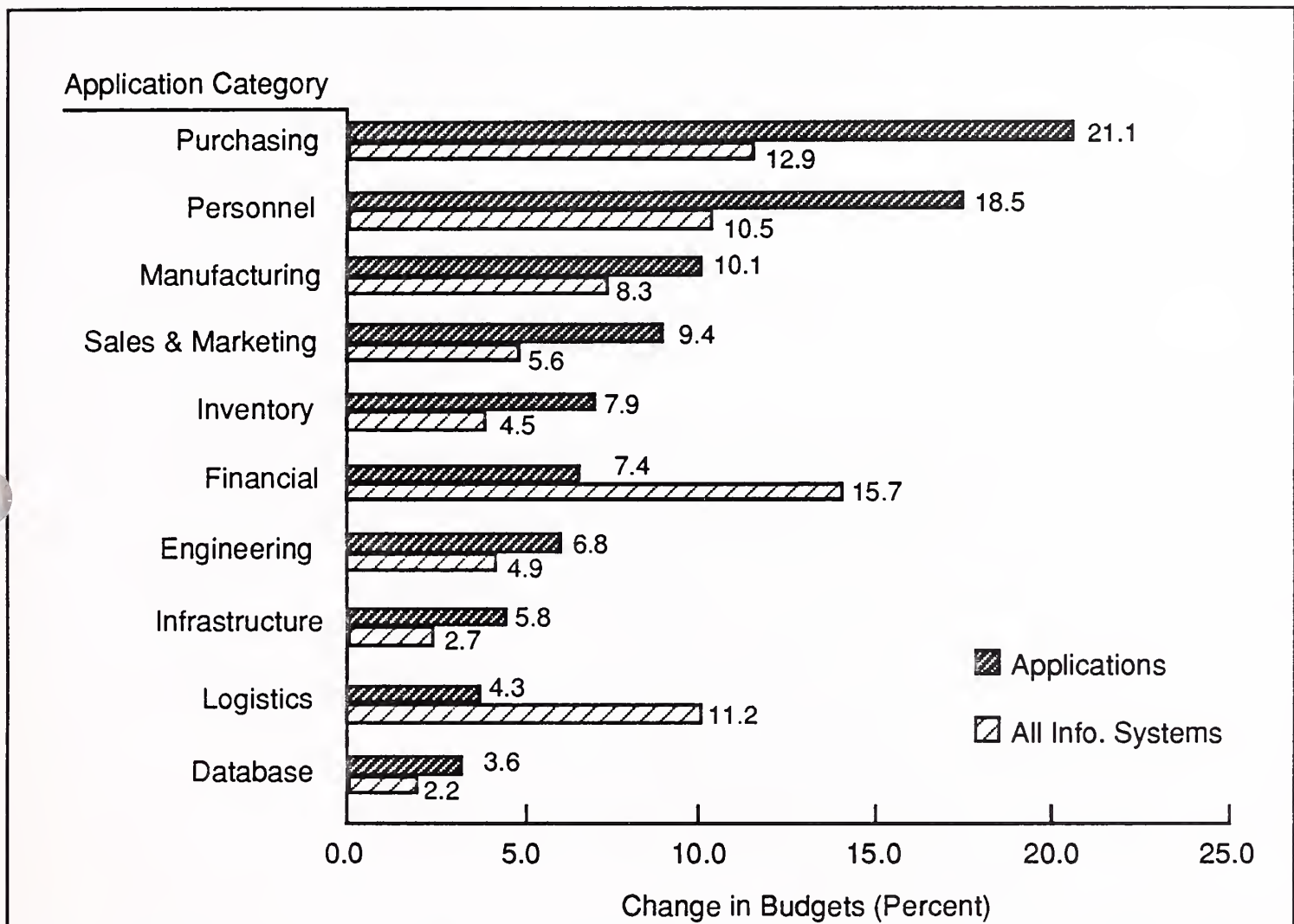
F
IS Department Objectives

In the most recent survey of process manufacturing firms, INPUT focused questions regarding information systems objectives on three areas: downsizing of applications, migration to client/server architectures, and increasing/decreasing emphasis on standardization.

The most pronounced trend evident from the survey is the migration to client/server. Respondents indicated that they planned to use C/S for 45% of planned applications overall. Exhibit III-8 summarizes the use of client/server by application category. Of the three most frequently mentioned applications, sales and marketing leads with 56% of planned applications going to client/server. Manufacturing applications are right at the average, with 45% planned for client/server, while financial applications lag at 40%. Although both mentions for "personnel" and four of the five for "logistics" applications noted a client/server strategy, the populations are too small to make the usage pattern significant. (See Exhibit III-2 for application/response data.)

Exhibit III-8

Process Manufacturing

Use of C/S by Application Category

Application Category	Proportion of Applications Planned for C/S (Percent)
Personnel	100
Logistics	80
Infrastructure	57
Sales/Marketing	56
Purchasing	46
Manufacturing	45
Financial	40
Inventory	35
Database	25
Engineering	22
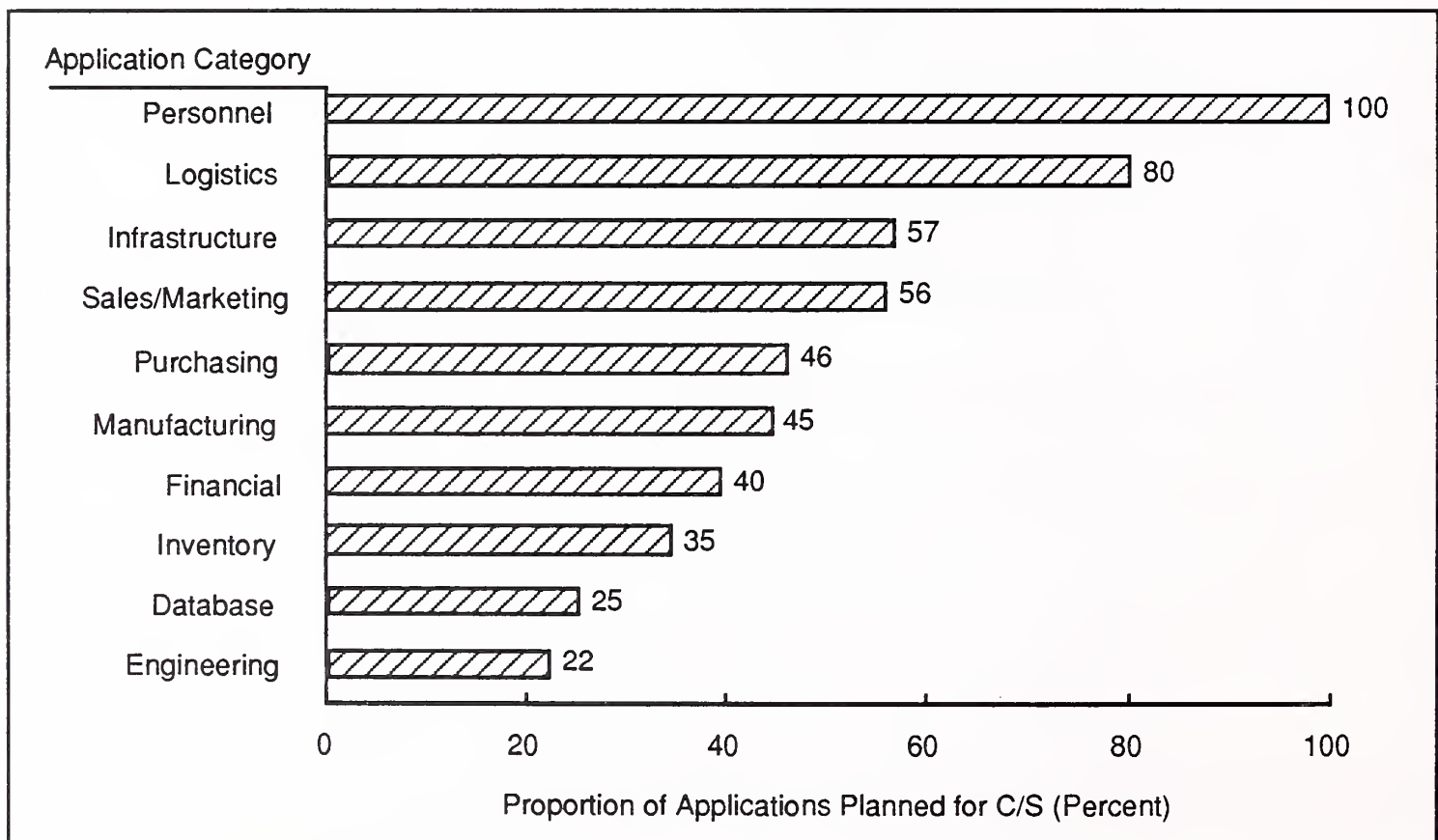
Thirty-three percent (33%) of all respondents said that they planned to downsize applications. As shown in Exhibit III-9, the three "hottest" application categories—financial, manufacturing,

and sales and marketing—are being downsized at a slightly higher rate. As with client/server applications, the "logistics" and "personnel" populations are too small to be statistically significant, but they are listed here to provide a complete picture of the response patterns.

Exhibit III-9

Process Manufacturing

Downsizing by Application Category

Application Category

Category	Value
Personnel	100
Logistics	40
Sales/Marketing	39
Manufacturing	38
Financial	35
Inventory	31
Purchasing	23
Infrastructure	18
Database	13
Engineering	11

Proportion of Applications Planned for Downsizing (Percent)
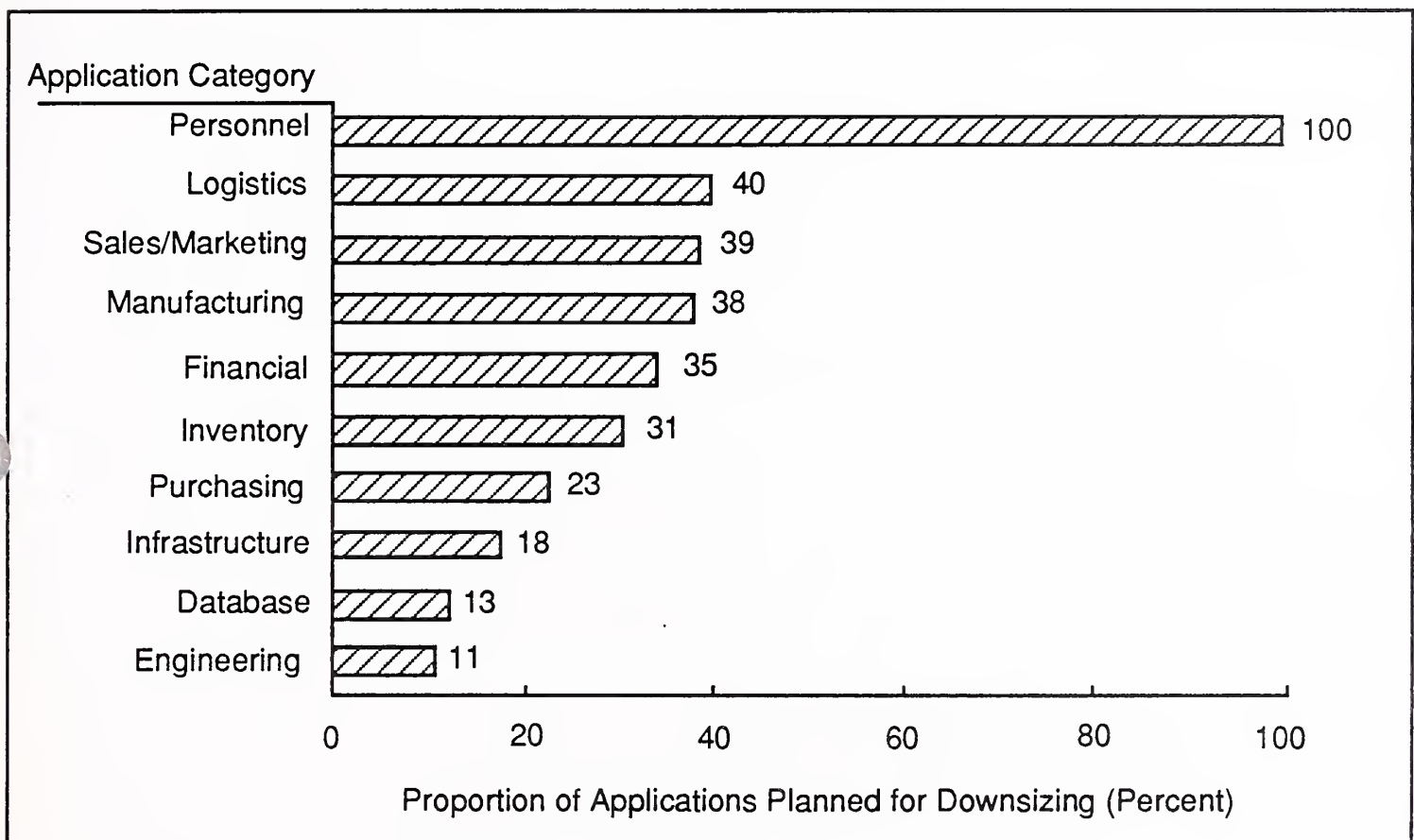
The vast majority of people interviewed were silent on the subject of standardization of platforms and operating systems. Only 10% of the respondents indicated that they were planning to increase standardization and 1% anticipated a decrease in standardization.

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IV

Market Forecast

A
Market Overview

The market for information services in the process manufacturing sector is expected to continue to have healthy growth through 1999. The analysis in this chapter is presented for seven product and service groups. They are:

- Applications software products
- Network services
- Processing services
- Professional services
- Systems integration
- Outsourcing
- Turnkey systems

As shown in Exhibit IV-1, the total market for these services is forecast at $8.4 billion in 1994 (a 13% growth over 1993), expanding to $16.4 billion in 1999, for a compound annual growth rate (CAGR) of 15%.

INPUT anticipates increased growth rates during the latter part of the forecast period as IS functions keep pace with changes in company infrastructures. As manufacturers continue to re-engineer their businesses in the drive to TQM, information systems must change.

Exhibit IV-1

Process Manufacturing

Information Services Market, 1994-1999
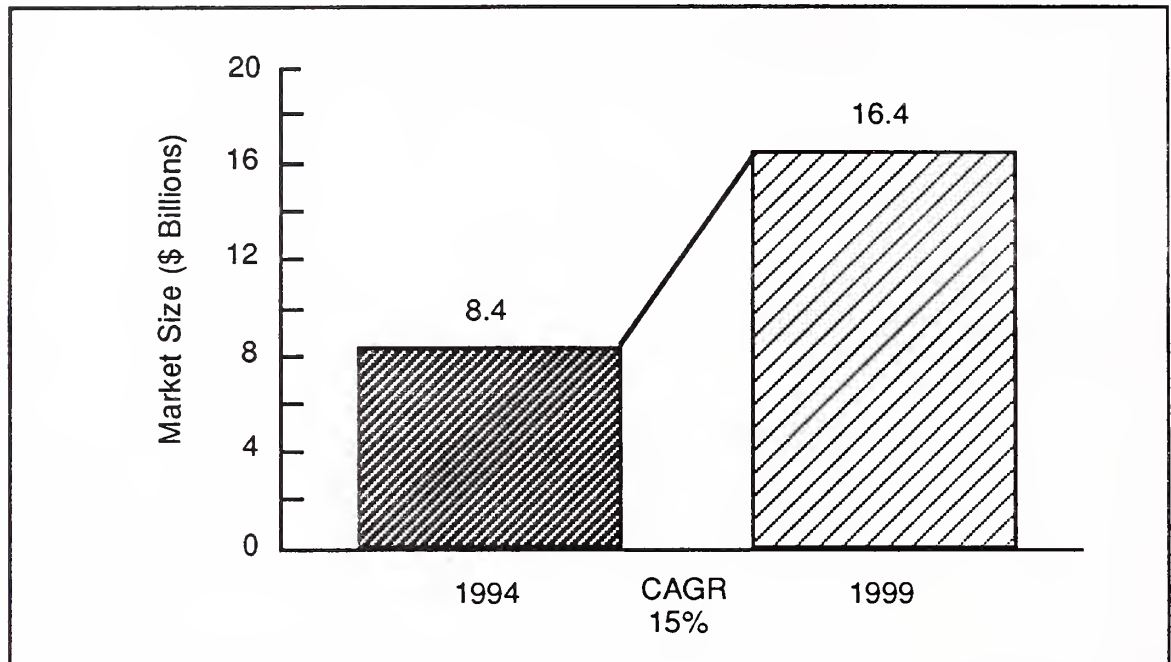
Values rounded.

1. Driving Forces

Business Process Re-engineering - The re-engineering of business processes is driving demand for information services in this sector. As companies restructure, the information systems function within a manufacturing company must respond with new techniques for providing immediate and accurate decision-making information. As traditional hierarchies flatten and the focused-cell teams become cross-functionally self-sufficient, many support functions are migrating to line roles. The move to client/server environments is compatible with this new structure.

Competition - Strong competition among the vendors is aiding growth in the IS market. Marcam, Ross, Andersen, and Datalogix have all developed systems directed solely at this industry sector. ASK and SSA have developed "offshoot" hybrid systems to meet many process requirements. In each product and service category there are several strong competing vendors, and, in general, no single vendor has gained dominance. In addition, highly specialized vendors are entering the market and carving out their own niches.

User Knowledge - The strong trend to client/server systems means that more users will be dealing with new systems. Users are being trained continuously in new methods of using information systems and are looking to the vendors to provide expertise. Training providers, including professional services firms, systems integrators and suppliers of turnkey systems, will all benefit.

2. Growth Inhibitors

Customization - Because open systems are not available across all applications, significant customization is still required to integrate new applications with existing ones. This slows both implementation of systems and realization of benefits. Though professional services vendors and systems integrators will benefit from such customization, total market expansion would occur more rapidly if there were less need for product modification. The allocation of dollars, by category, should change over the forecast period toward more product sales as open systems become available.

Vendor Sales Personnel - Product vendors often fail to provide in-depth training in manufacturing applications for their own personnel, concen-trating instead on product training. Consequently, sales people tend to fo-cus on the features of their products, rather than the problems of the customer. A fundamental communications gap develops, with vendors talking about product features and buyers trying to understand how all this helps them do their job. Third-party consultants are often hired to assist in the evaluations, adding another element to the decision process. Furthermore, with increasing focus on integration of manufacturing systems, buying and implementation decisions are made by committees. As manufacturing software continues to evolve and becomes more and more complex, it becomes increasingly difficult for buyers to differentiate between alternatives, with the net result that the buying process is lengthened.

B
Forecast by Product and Service

Exhibit IV-2 displays expenditures and growth rates by product and service category.

Exhibit IV-2

Process Manufacturing

Market Size Forecast

Delivery Mode	1994	1999	CAGR (Percent)
Professional Services	2.9	5.9	15
Network Services	1.3	2.8	17
Outsourcing	1.1	2.5	17
Applications Software	.9	2.1	18
Processing Services	.8	1.0	3
Turnkey Systems	.8	1.3	10
Systems Integration	.5	1.0	15

Market Size ($ Billions)
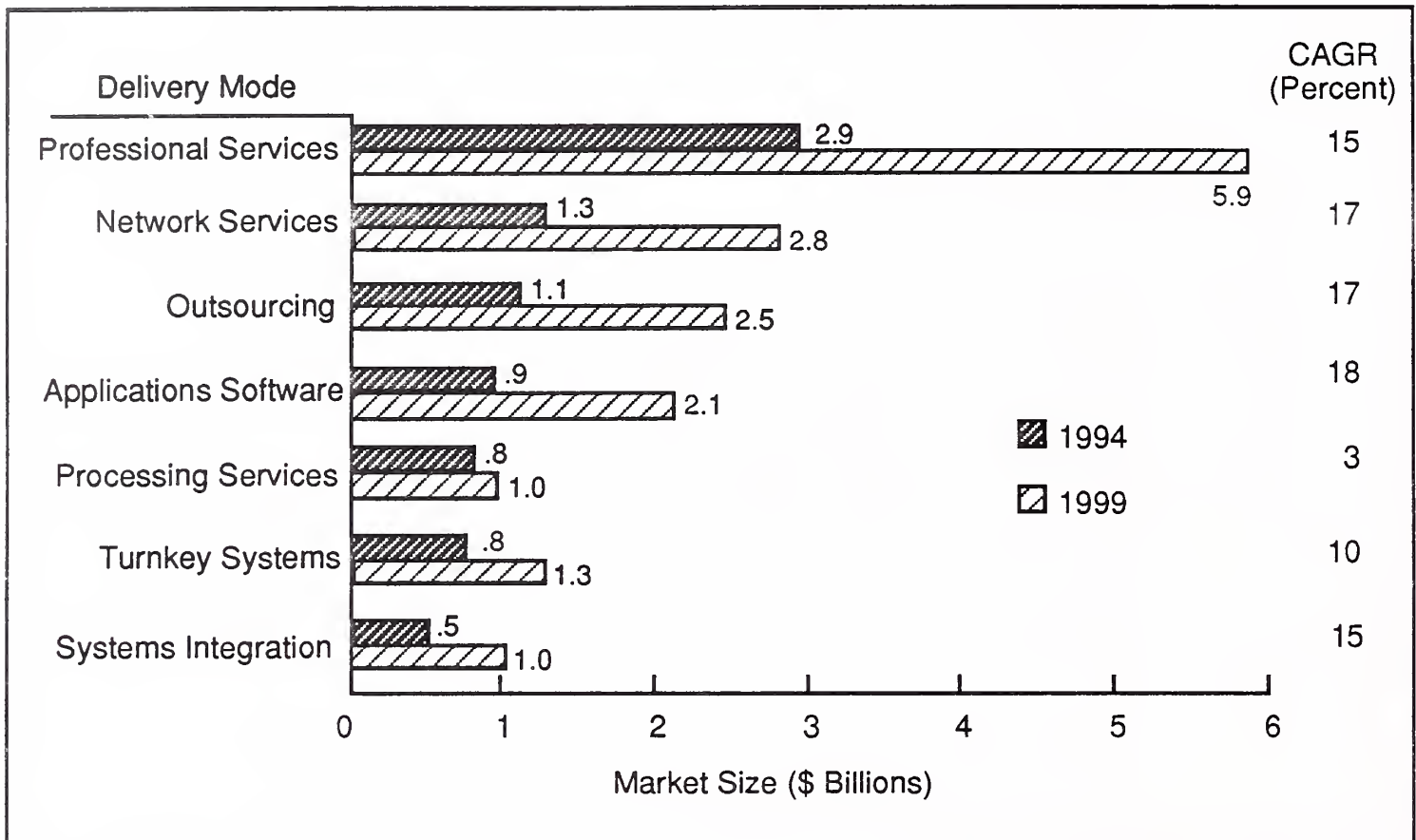
Values rounded.

C

Analysis

1. Professional Services

The largest category of information services expenditures is professional services. At just under $3.0 billion in 1994, and growing at 15% throughout the forecast period to almost $5.9 billion, it represents a substantial opportunity. INPUT expects IS consulting and software development to grow steadily, and education and training to accelerate slightly as manufacturers continue internal education efforts for new technologies such as client/server.

2. Network Services

Network applications and network management (outsourcing) are the two fastest growing market segments—a reflection of the

growing importance of sophisticated telecommunications in this sector. EDI, the growing recognition of electronic commerce, and electronic filing of government reports are important facilitators.

The rate of growth is expected to accelerate from 15% to 17%, and expenditures to rise from $1.3 billion in 1994 to almost 2.8 billion in 1999.

3. Outsourcing

Outsourcing is divided into platform, applications, desktop services, and network management. Growth in this area is forecast at a 17% CAGR through 1999, from $1.1 billion in 1994 to almost $2.5 billion in 1999.

INPUT's view is that client/server implementations and downsizing will create needs that can't be served in-house. Desktop services and network management are expected to be the fastest growing components.

4. Applications Software

Growth in this area is consistent with the 1993 report, except for mainframe and workstation/PC expenditures, which are up by one percentage point each. With mainframes increasingly being used as super-servers in client/server systems, the decline in the use of mainframe for new applications is not occurring as rapidly as expected. INPUT expects expenditures to reach $2.1 billion in 1999, up from $942 million in 1994.

5. Processing Services

Processing services continues to be the slowest growing product/service category in the information services market, losing ground to more aggressive approaches tailored specifically to meet customer needs. Growth has declined to 3%, and is expected to continue its downward trend as more specialized solutions become available.

6. Turnkey Systems

The growth of the equipment component of turnkey systems will decline as technology improvements drive costs down, but overall growth will continue at a steady 10%, fueled by the demand for

applications software and professional services. Expenditures should rise from 1994 levels of $768 million to over $1.2 billion in 1999.

7. Systems Integration

Systems integration will grow at a CAGR of 15% during the forecast period as a result of increased demand for single-source responsibility on major IT projects. Manufacturers who are re-engineering their businesses often find that they require specific knowledge in multiple disciplines, which is seldom available in-house. Consequently, the professional services component of SI will grow the fastest. Total expenditures will increase from $505 million to $1 billion between 1994 and 1999.

V
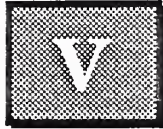
Competitive Environment

This chapter presents an analysis of information services vendors serving the process manufacturing sector. The chapter is divided into the following sections:

- Competitive Climate
- Competitive Positioning
- Participating Vendors
- Selected Vendor Profiles

In the conduct of its research, INPUT conducts extensive analyses of vendor revenues. In order to present useful and accurate information for the process manufacturing market, U.S. revenues are separated from worldwide revenues, and revenue is split between discrete and process manufacturing sectors, in instances where an information services vendor serves both sectors.

A
Competitive Climate

Every vendor in this market sector has struggled over the past two years to deliver products that run in a UNIX environment with a relational database and a graphical user interface. While most can now point to customer installations of these new systems, few have completed the process. The time needed to develop new products is lengthening and product life cycles are shrinking.

At the same time, vendors known primarily for turnkey systems are rapidly shifting to become software companies that support multiple platforms.

The strategic focus for information systems projects continues to be integration, integration, integration. Systems vendors must

offer systems that tie the whole enterprise together, moving from manufacturing resource planning (MRP) to enterprisewide resource planning (ERP). Information systems and services vendors participating in this marketplace need to understand that systems decisions are being made in the context of business process re-engineering.

B
Competitive Positioning

A weak economy both in the U.S. and abroad over the past few years occurred at a time that vendors needed to make significant investments in migrating their products to an open architecture. This combination hurt profits, especially in companies such as The ASK Group, that were late to update their product offerings. To participating vendors, the market is characterized by increased competition and pricing pressure.

There is also increased alliance and acquisition activity as companies try to gain product development expertise, market share, and experience in vertical market segments. Marcam, one of the leading vendors to the process manufacturing market, purchased the rights to the IBM MAPICS product, gaining a substantial customer base for future sales. It has also purchased Varnet, a small MRPII vendor, giving it access to 4GL and relational database management (RDBM) capabilities.

Process manufacturing vendors can be considered in the following segments:

1. Traditional MRP

American Software
Andersen Consulting
The ASK Group
Cincom Systems
Computer Associates
qad.inc.
SAP America
Symix Systems, Inc.
System Software Associates

2. Cell Controllers

Fastech
Savior
US Data

3. Manufacturing Execution Systems (MES)

Consilium
Effective Management Systems
Promis

C
Participating Vendors

1. Applications Software Vendors

Requirements for CAD applications to have both powerful software and high-performance graphics makes CAD/CAM one of the best uses of specialized open-design software and turnkey systems in process manufacturing. Although CAD/CAM was once the leading application product for turnkey systems in process manufacturing, there is a concerted move toward open systems that has unbundled CAD/CAM software from traditional platforms. Exhibit V-1 lists the leading applications software vendors in process manufacturing. CAD/CAM software firms are not listed, as they are part of INPUT's report on cross-industry engineering applications. Cell controller vendors are listed because they have become an integral part of the re-engineered business, and they have the ability to assist in the integration of plant devices with other business systems. Most process manufacturers have made extensive use of statistical process control (SPC) and automated product movement devices, and those devices can now be integrated more easily with the use of packaged products.

Exhibit V-1

Leading Applications Software Vendors

- The ASK Group
- System Software Associates
- Marcam
- American Software
- SAP America

2. Professional Services Vendors

Exhibit V-2 presents the leading professional services vendors in process manufacturing.

Exhibit V-2

Leading Professional Services Vendors

- Analysts International
- Andersen Consulting
- Computer Sciences Corp.
- Computer Task Group
- Coopers & Lybrand
- EDS
- Ernst & Young
- IBM

The vendors in the professional services market are extremely diverse, including Big 6 firms, subsidiaries of industrial firms, computer hardware makers, and vendors devoted solely to professional services.

The professional services market is the largest service mode in process manufacturing, and there are no vendors with a significant market share; the market is extremely fragmented.

3. Leading Systems Integrators

Systems integration services offered to the process manufacturing market are characterized by increased competition and high margins of return. The systems integration market is growing fast. Critical factors for vendors are knowledge of the key business issues in manufacturing and experience in implementing solutions in the industry. Exhibit V-3 lists the leading systems integration vendors in process manufacturing.

Exhibit V-3

Leading Systems Integrators

- Andersen Consulting
- Computer Sciences Corp.
- Computer Task Group
- Coopers & Lybrand
- Deloitte Touche
- EDS
- KPMG Peat Marwick
- Price Waterhouse

4. Leading Outsourcing Vendors

The outsourcing segment is also marked by an absence of clear leaders. Exhibit V-4 lists the larger outsourcing vendors in process manufacturing.

Exhibit V-4

Leading Outsourcing Vendors

- Andersen Consulting
- Computer Sciences Corp.
- EDS
- IBM
- Litton Automation

Growth and effective alliance positioning have made each of these companies a strong competitor in the process manufacturing market.

D
Selected Vendor Profiles

1. SAP America

International Court One
100 Stevens Drive, Suite 350
Lester, PA 19113
(215) 521-4500
President: Klaus Besier
Wholly Owned Subsidiary of SAP AG
Total Employees: 420
Total Revenue: $129,000,000
FYE: 12/31/93

a. Company Background

SAP America, Inc. markets and supports the client/sever-based R/3 System, and the mainframe-based R/2 System, fully integrated applications software systems designed to integrate the information needs of Fortune 500 companies. SAP America was established in January 1988, and operates as a wholly owned subsidiary of SAP AG, developer of the R/2 System.

- SAP AG was founded in 1972 in Walldorf (Germany) by four former IBM engineers.

- In 1985, SAP International was formed in Biel (Switzerland) to support the marketing and sales activities of SAP AG's international subsidiaries. SAP International's operations were consolidated into SAP AG's headquarters in Walldorf in April 1992.

- SAP AG reported sales of $665 million (U.S.) for 1993, an increase of 32% over 1992 sales. SAP AG currently has 3,500 employees, 28 international subsidiaries, and more than 3,000 customers in 36 countries.

b. Strategy

SAP's challenges are to expand its international coverage and customer base; exploit opportunities in eastern Europe; and at the same time extend market coverage to small and medium-sized organizations in North America and Western Europe.

To address the needs of large and midsized corporations that require integrated applications systems using an open systems, client/server strategy, SAP introduced the R/3 System, with first deliveries to North American customers in September, 1992.

Like the R/2 System, the R/3 System provides a range of on-line, real-time, integrated business applications. Also like R/2, R/3 customers can address specific applications needs while laying the foundation for a single, enterprisewide strategy.

The delivery of R/3 to North America was ahead of SAP's announced schedule and well ahead of major competitors such as System Software Associates and The ASK Group.

c. Products and Services

The R/3 System is an integrated set of ten business applications modules that manage a range of strategic business applications for data-intensive corporations with numerous locations and operations.

- The core of the R/3 System is the Basis System, which contains development tools for the system and provides interface capabilities that allow users to access database information in any module from anywhere in the company.

- R/3 System modules include:

  - RF: Financial Accounting

  - FA: Fixed Assets

  - RK: Cost Accounting

  - RK-P: Project Planning and Control

  - RV: Sales-RM-PPS: Production Planning and Control

  - RM-MAT: Material Management

  - RM-QSS: Quality Assurance

  - RM-INST: Plant Maintenance

  - RP: Personnel Management

- Modules are available and priced separately. Pricing on the Basis System starts at $100,000, depending on configuration.

d. Key Issues

- SAP America has strategic alliances and relationships with professional services firms and systems integrators that augment its sales and support efforts in the U.S. SAP Alliance partners include Andersen Consulting, CAP Gemini America, Computer Task group, Coopers & Lybrand, Deloitte Touche, Ernst & Young, KPMG, Price Waterhouse and SHL Systemhouse.

- Despite its relatively recent introduction, the R/3 System accounted for more than 80% of the company's 1993 North American revenues.

2. System Software Associates

500 West Madison Street, 32nd Floor
Chicago, IL 60661
Phone: (312) 641-2900
Fax: (312) 641-3737
Chairman, President, and CEO: Larry J. Ford

Status: Public
Total Employees: 1,500
Total Revenue: $263,400,000
FYE: 10/31/93

a. Company Background

System Software Associates, Inc. (SSA), founded in 1981, develops, markets, and supports BPCS (Business and Planning Control System), an integrated line of business software for manufacturing, financial and distribution management applications designed to run on IBM's AS/400 as well as the IBM RS/6000 and the HP-9000. SSA's revenue is derived primarily from the process manufacturing, discrete manufacturing, and distribution industries. SSA sells and supports its products through its affiliate network, a major accounts organization, and branch offices.

b. Strategy

SSA defines its market as the industrial sector, and aims its products at international companies. In June, 1993, SSA announced an open systems strategy, marking a departure from its focus on the IBM AS/400 and S/3x platforms. Delivery of the first open systems version of the products in the announcement was scheduled for "early 1994."

The company also changed its organization from a regional to a country focus, establishing entrepreneurial, self-sufficient teams in each country where it is represented.

c. Products and Services

Seventy-one percent (71%) of SSA's fiscal 1993 revenue was derived from license fees, 29% from client support services and other sources. SSA's primary software product line, known as the Business Planning and Control System (BPCS/AS), consists of integrated products designed for manufacturing, distribution, and financial applications. This set of applications is augmented by EDI/SET, to support electronic data interchange for the BPCS/AS applications, and AS/SET, CASE tools that facilitate customization of the applications.

During 1993, the company acquired Elke Corp., a provider of software for tracking and managing the maintenance of equipment, facilities and vehicles. The product line, called Main/Tracker, has 2,500 installations, and as is the case with the other SSA products, is migrating to an open system, client/server approach in 1994.

d. Key Issues

- The rate of revenue growth from fiscal 1991 to 1993 declined, primarily as a result of weakened economies in SSA's major overseas markets and diminished foreign revenues due to a strengthening of the U.S. dollar. Competition from other vendors whose open systems offerings were available for shipment in 1993, notably SAP, was a factor as well.

- Revenue growth was also reduced by the planned reduction in hardware reseller sales associated with SSA's withdrawal from the IBM U.S. Industry Remarketer program.

- There was an increase in sales by existing affiliates and continued expansion of the company's global affiliate network.

- SSA effected direct entry into key markets, usually by acquiring the affiliate in the market.

- SSA expanded its client services groups, which increased revenues by 50% in fiscal 1993.

- SSA introduced the new BPCS/AS and AS/SET products.

- SSA's HelpLine, a telephone support service for SSA's software clients, is in the process of certification according to ISO-9000 standards.

- SSA's primary competitors for its BPCS product line include American Software, Andersen Consulting, ASK Computer Systems, and Marcam. CASE competitors include Synon.

3. The ASK Group

2880 Scott Blvd.
Santa Clara, CA 95052
Phone: (408) 562-8800
President and CEO: Eric Carlson
Status: Public
Total Employees: 2,300
Total Revenue: $426,213,000
FYE: 6/30/93

a. Company Background

The ASK Group develops, markets, and supports manufacturing
and financial management applications for HP, DEC, IBM
midrange, and UNIX-based computers that are available as
software products or turnkey systems, and via processing
services. As a result of the acquisition of Ingres Corporation, The
ASK Group also provides relational database management
systems (RDBMSs) and application development tools for open
systems.

b. Strategy

The ASK Group has pursued a strategy of diversification through
the development and acquisition of core software technologies,
intelligent relational databases, fourth-generation language (4GL)
development environments, application development tools, and
open application products, in addition to its traditional
manufacturing and financial management applications products
for Hewlett-Packard (HP), DEC, and IBM midrange systems.

The company's development plans include moving its
applications to an open systems environment with its software
operating on all the major hardware platforms.

The company is also concentrating on selling software and
services, and continues to de-emphasize low-margin third-party
hardware sales. Marketing is focused on expanding both direct
and indirect channels of distribution. The company's strategy is
to sell directly only when it adds value, and in all other cases to
leverage sales through VARs, systems integrators and
distributors

c. Products and Services

Database and Connectivity - These products include the ASK INGRES Intelligent Database, Knowledge Management, Replicator, Enhanced Security, Net, Star and Gateway products for Intel-based, DEC, HP, Sun Microsystems, and IBM computers, minicomputers, workstations, and PCs running proprietary and UNIX operating systems. In addition, Ingres products have been ported to operate with a range of computers from other computer system companies.

Applications - The ASK MANMAN Information System is an on-line, interactive system that consists of integrated products for manufacturing, finance, marketing, customer service, decision support, and computer-integrated manufacturing functions. There are currently over 2,000 MANMAN clients worldwide. The products run on HP, DEC and UNIX systems.

ASK SIM/400 supports manufacturing, accounting, bar code, distributed requirements planning (DRP), sales order management, multiple CPU distributed requirements planning, and EDI functions.

Tools - The tool products allow customers and systems integrators to adapt the manufacturing products to specific needs. They include ASK Windows4GL, ASK Vision, query and reporting tools and imbedded languages.

d. Key Issues

- The ASK Group continues to de-emphasize its hardware reselling activities and focus on its software and services business. Prior to the 1990 acquisition of Ingres, about 80% of revenue was from the U.S. and hardware resales accounted for more than 50% of total business. Now 51% of revenue comes from international markets and more than 88% is from software licenses and services.

- The company has expanded its client base to include not only manufacturing customers, but also customers in international banking, government, transportation, telecommunications, advanced research, and retail.

- Sales in 1993 declined 1.4% over 1992 sales, to $426 million. The company posted a nominal profit of $149,000 in 1993, compared to a loss of $47.7 million the previous year.

- The ASK Group attributes its problems to being slow to move its flagship manufacturing products away from proprietary operating systems for DEC/VAX, HP-3000 and IBM AS/400 computers. The company shipped 100 licenses of UNIX-based ASK MANMAN/X in 1993.

- In March, 1994, Eric Carlson was appointed president and chief executive officer of The ASK Group, replacing Pier Carlo Falotti, who resigned.

4. qad.inc

qad.inc
6450 Via Real
Carpinteria, CA 93013
Phone: (805) 684-6614
President and CEO: Pamlea Lopker
Status: Private
Total Employees: 400
Total Revenue: $65,000,000
FYE: 12/31/93

a. Company Background

qad.inc, founded in 1979, develops, markets, and supports integrated manufacturing, distribution and financial applications software. The company's flagship product, MFG/PRO™, is targeted to discrete and process manufacturing environments.

In addition to its headquarters near Santa Barbara, California, qad has direct sales/support offices in Atlanta, (GA); Boston, (MA); Chicago, (IL); Dallas and Houston, (TX); Grand Rapids, (MI); Los Angeles, and San Jose, (CA); Mt. Laurel, (NJ); Phoenix, (AZ), Portland, (OR); and Toronto (Ontario, Canada).

In Europe, the company has direct sales/support offices in Amsterdam, Berlin, London and Paris, and distributors in 14 countries.

In the Asia/Pacific, the company has direct sales/support offices in Hong Kong, Sydney and Melbourne, and distributors in 10 countries.

One hundred percent of qad's revenues are from manufacturing, both discrete and process, with 80% coming from applications software licenses and the remainder from associated professional services. Approximately 55% of the company's business is in North America, 30% in Europe and 15% in the Asia/Pacific region.

b. Strategy

qad's principal strategic focus is the penetration of international markets utilizing a product set that was designed with an open systems architecture. This open design has given qad a lead over competitors that are still investing heavily in re-engineering their products.

qad differentiates itself from its larger competitors by emphasizing the strength of its manufacturing modules, as well as its open system design. The company emphasizes its ability to manage the entire "supply chain" from customer demand, back through shipping, manufacturing, receipt of materials and purchasing.

Because its products run on such a wide variety of hardware platforms, it can offer the customer the lowest total price by tailoring the network to fit the situation exactly.

The company concentrates on three industry groups: automotive; electrical and industrial products; and consumer packaged goods, more specifically: food and beverage, health and beauty aids, and pharmaceuticals.

c. Products and Services

MFG/PRO is an integrated manufacturing, distribution and financial software product that addresses the entire process manufacturing spectrum from repetitive to configure-to-order. Key features of the product are:

- MFG/PRO is written using the PROGRESS fourth-generation language and relational database system and has a built-in report writer to facilitate customization. It runs on all operating systems and platforms supported by PROGRESS, which include UNIX, HP-UX, UTLRIX, VMS AND MS-DOS on over 400 hardware platforms.

- The product has multi-site, multi-national, multi-currency and multi-language capabilities and supports repetitive, make-to-stock and configure-to-order manufacturing environments, as well as process and batch-process environments.

d. Key Issues

During 1993, the company released version 7 of MFG/PRO, which features a distributed database and a release management system.

Though lacking the resources of publicly held competitors such as SAP, SSA and ASK, qad.inc continues to grow at over 80% per year. Sales for the year ending 12/31/93 are estimated at $65 million, compared with $35 million for 1992 and $19 million in 1991.

The company is increasing its emphasis on strategic relationships with CAP Gemini, Origin, and numerous national and regional firms around the world.

5. Marcam Corporation

95 Wells Avenue
Newton, MA 02159
Phone: (617) 965-0220
CEO: Paul Margolis
Status: Public
Total Revenues: $126,000,000
Total Employees: 1,040
FYE: 9/30/93

a. Company Background

Marcam was founded in 1980 as an applications software company. It distributed and provided add-on products and consulting services to MAPICS, IBM's manufacturing system for midrange computers, prior to developing the PRISM product.

In April 1991, Marcam acquired ShawWare Incorporated of Burlington (Ontario, Canada), a supplier of maintenance and materials management applications software. The acquisition resulted in the addition of six modules to the PRISM product line.

In late 1992, Marcam purchased the rights to IBM's MAPICS, giving it a large customer base. That moved Marcam into the discrete manufacturing market for the first time, and one challenge will be to keep its attention on its primary domain, the process market. Marcam has also purchased Varnet, a small MRPII-type vendor, giving it access to a product and expertise in the UNIX, 4GL and RDBMS environments. The company recently announced Object Technology Initiative, which is says will enable it to provide custom-configured application components to its customers.

The company's FY 1993 revenues reached $126 million, a 57% increase over 1992 revenues of $80.3 million.

b. Strategy

Marcam is one of the few applications software companies focusing exclusively on process manufacturing. Marcam recognized the unique manufacturing requirements of the process industries, and the lack of software systems designed exclusively for these industries. To meet those needs, the company developed and currently markets PRISM, an integrated manufacturing, financial, logistics, and cost accounting software product.

Marcam worked very closely with more than 50 process manufacturers, many of which are among the Fortune 100, to develop the product. Marcam also provides implementation support, custom programming, and systems integration services for a total process manufacturing solution. As a result, the company has gained a good deal of respect from the process manufacturing industries and is recognized as understanding

the specific problems that exist within those industries. The company has cultivated this image, and is reaping the rewards of being a vendor with a very close relationship to process manufacturing

c. Products and Services

The PRISM product family, introduced in 1986, includes an integrated planning and control software system targeted to process manufacturers. The software is designed for IBM AS/400, IBM System/38 and IBM PCs and compatible systems. Marcam has licensed over 3,600 PRISM modules for use at more than 650 sites worldwide. PRISM consists of 28 announced modules that are organized into four product lines—Production Series, Logistic Series, Maintenance Management Series, and Financial Series—as well as common functions or enablers.

6. Consilium, Inc.

640 Clyde Court
Mountain View, CA 94043
Phone: (415) 691-6100
President and CEO: Thomas A. Thomasseti
Status: Public
Total Revenues: $28,500,000
Total Employees: 280
FYE: 10/31/93

a. Company Background

Consilium provides integrated plant floor management software products and related services to discrete and process manufacturers. The company's WorkStream and FlowStream software products run primarily on DEC hardware. DEC and EDS are investors in Consilium.

Consilium was incorporated in October 1978 to provide consulting services, primarily to semiconductor, aerospace and defense industries. Its first product, WorkStream, developed for the semiconductor industry, began delivery during fiscal 1983. Consilium's newest product, FlowStream, was developed as an open system and addresses a variety of process manufacturing environments.

b. Strategy

Consilium's approach to sales and marketing is directed at the plant floor as a manufacturing execution system (MES). The company uses its expertise to provide customers with extensive consulting and implementation services to assure the best use of its products' capabilities. It is common for vendors of complementary products (like Marcam) to work toward integration with Consilium.

Consilium's primary competition comes from in-house development departments and from systems integrators like Andersen Consulting and IBM. It also receives competition from Promis, Inc., which has a similar approach to implementations.

Consilium's competitive strength lies in its experience and expertise in the manufacturing industries. FlowStream should give it significant competitive technical advantages as the market moves toward open systems.

c. Products and Services

The FlowStream product should address both the functional and technical requirements of most process manufacturers and should position Consilium well for future product integration needs.

d. Key Issues

The major issue facing Consilium is its ability to continue sales growth and regain profitability. Its approach to sales has not changed to meet lengthening sales cycles. Its association with no-growth situations (DEC, defense, aerospace) has added to a two-year stagnation. The company posted a profit of $3.2 million in 1990, but since then has faced losses to $5.3 million in 1992 and 1993. For the first quarter ending 1/31/94, losses were $1 million on revenues of $7 million, versus losses of $1.6 million on revenues of $6 million a year ago.

User Buying Patterns

A
Application Plans

In INPUT's survey of process manufacturers, respondents were asked to specify which, if any, outside resources they planned to use in developing new applications. Questions specifically focused on:

- Packaged applications software

- Systems integrators

- Other outside resources, e.g., professional services firms

Exhibit VI-1 summarizes responses by application category. The term "buy" indicates that a respondent intended to use one or more of the above outside resources, while the term "make" reflects a response that no outside resources were planned for implementation of the application. Key observations are:

- Overall, respondents plan to buy 42% of new applications. Financial systems represent the largest opportunity for IS providers, with just over half of the 54 new applications targeted for outside assistance. This reflects the maturity of products in this category, as well as the high degree of standardization of these applications.

- Outside resources will be used in 28% of the 100 manufacturing applications. The proportion of respondents planning to use outside resources is comparable to that found in discrete manufacturing.

Exhibit VI-1

Process Manufacturing

New Applications—Make versus Buy
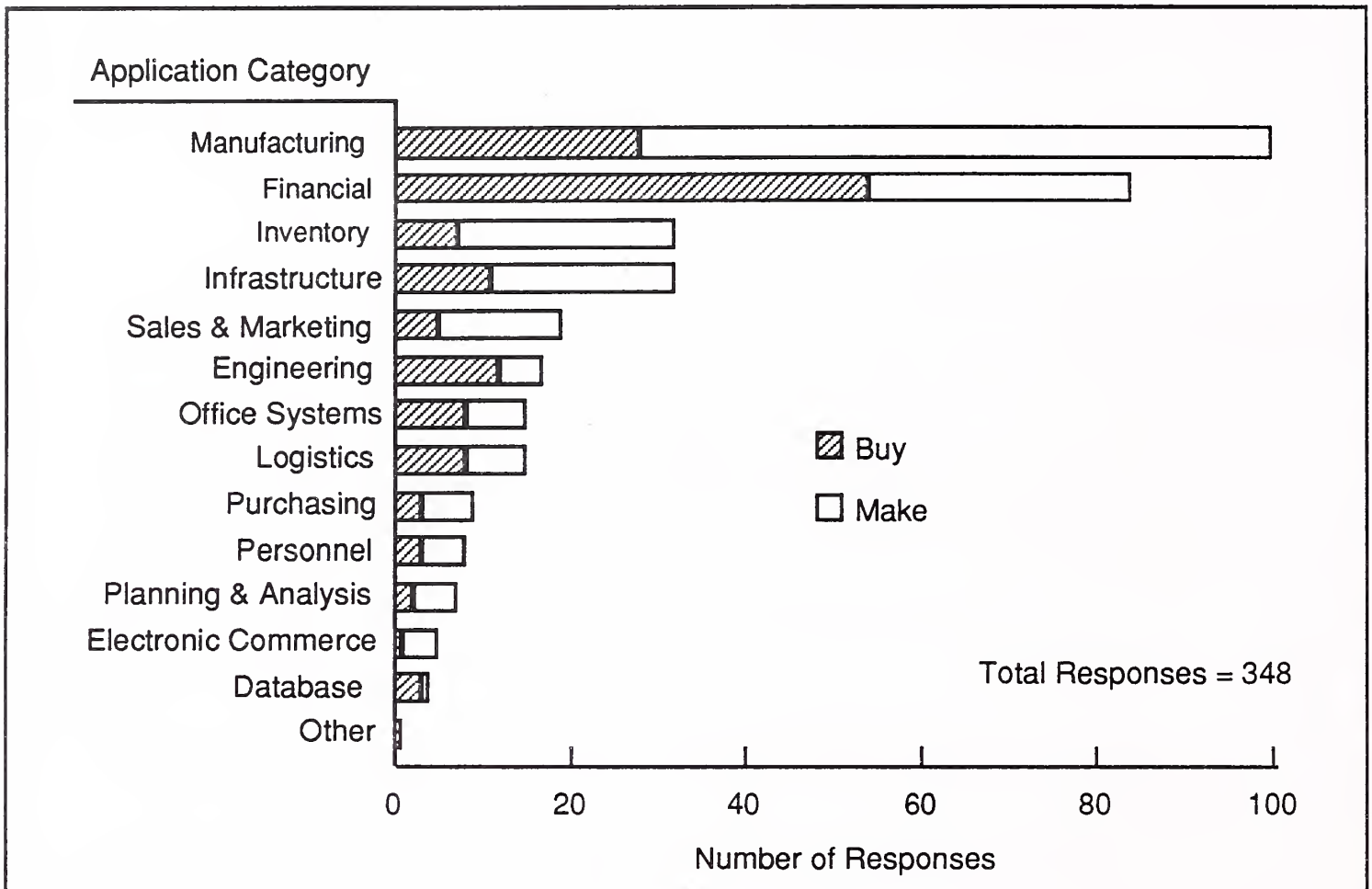
Exhibit VI-2 shows the proportion of respondents for each application category that plan to use the services of IS providers.

Exhibit VI-2

Process Manufacturing

Opportunities for Information Services Providers

Application Category

Application Category	Value
Database	75
Engineering	71
Financial	64
Office Systems	53
Logistics	53
Personnel	38
Infrastructure	34
Purchasing	33
Planning & Analysis	29
Manufacturing	28
Sales & Marketing	26
Inventory	22
Electronic Commerce	20

Proportion Planning to Buy from IS Vendors (%)

(x-axis: 0 10 20 30 40 50 60 70 80)
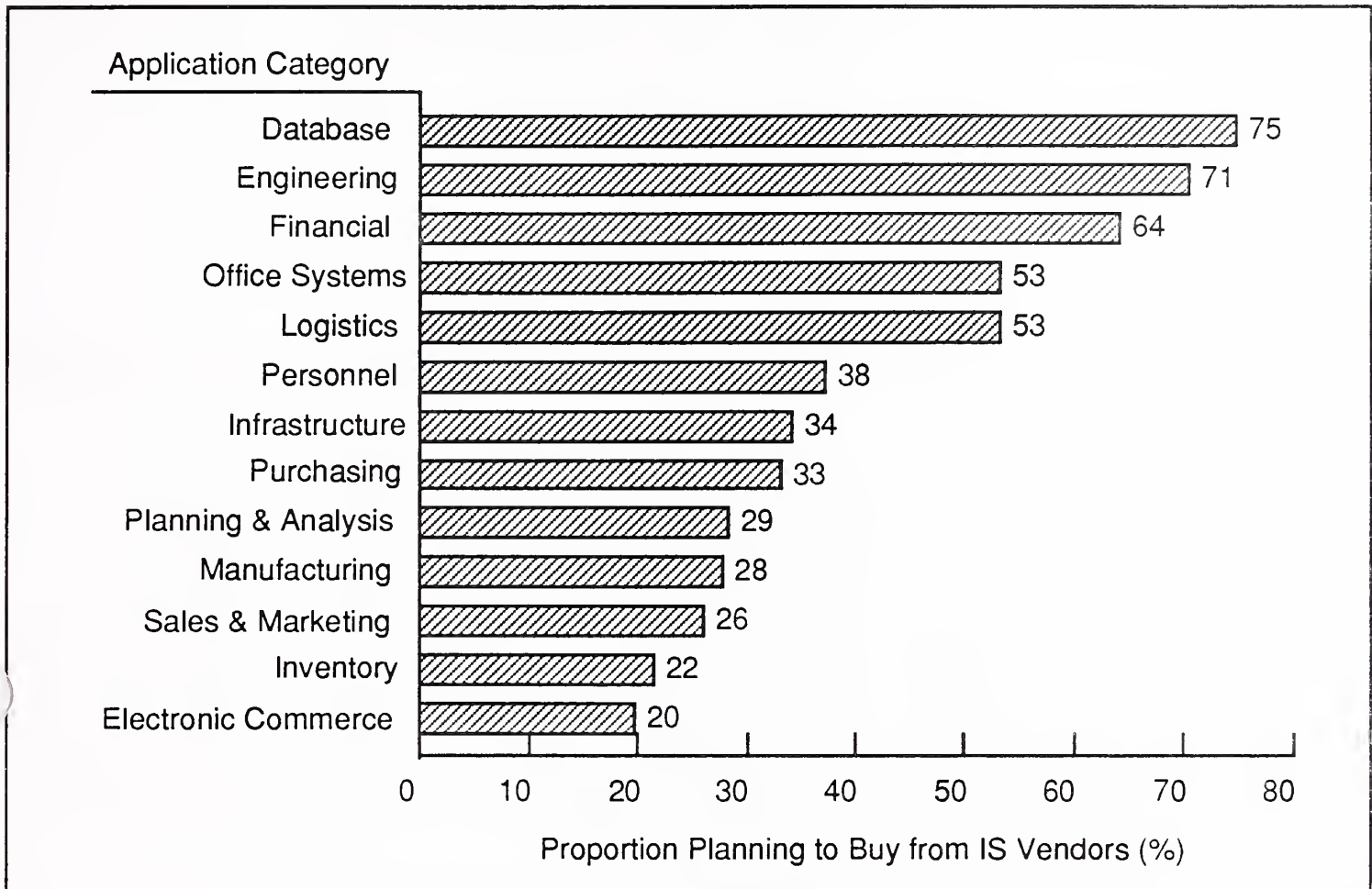
Outside resources are used to the greatest extent in database and engineering applications, though relatively few of these applications are planned. As noted earlier, financial applications represent the largest opportunity for information services providers, both in absolute numbers and the proclivity of buyers to look outside for assistance.

B
Timing of New Applications

Respondents were asked when they intended to begin each planned application. As shown in Exhibit VI-3, the planning horizon for new applications in this sector extends to 48 months, but 65% of all new projects are planned to begin in seven to twelve months.

Exhibit VI-3

Timing of New Applications

Category	1-3 months	4-6 months	7-12 months	13-24 months	25-48 months	Total
Database	0	0	5	0	0	5
Electronic Commerce	0	1	3	1	0	5
Financial	5	7	33	21	4	70
Personnel	1	0	6	3	0	10
Infrastructure	0	2	21	1	2	26
Inventory	0	2	26	6	0	34
Logistics	0	0	5	2	0	7
Manufacturing	1	18	70	15	3	107
Office Systems	0	2	10	2	1	15
Planning & Analysis	0	1	5	1	0	7
Purchasing	0	1	9	1	0	11
Sales & Marketing	1	1	7	3	0	12
Engineering	1	1	15	4	2	23
Other	0	0	0	1	0	1
Total All Applications	9	36	215	61	12	333

VII

Conclusions and Recommendations

A
Industry and Information Services Market Conclusions

Process manufacturing industries have recovered from the recession, and are continuing to re-engineer their businesses to achieve high levels of customer service and quality. They continue to move decision making closer to both opportunities and problems (usually opposite sides of the same coin). As manufacturers strive to reduce cycle times, such decision making requires integration of information at various locations both inside and outside the company. These needs present excellent opportunities for the vendors of information services.

However, process manufacturers are approaching new information services expenditures slowly and with caution. As companies have moved toward automating individual processes, islands of automation/information have resulted. There is a need for complete integration of those systems to achieve real-time sharing of data within a company.

Today the focus is on integration and the trend is toward totally open, totally integrated systems that are database-independent, platform-independent, and vendor-independent. INPUT expects that object-oriented systems will begin to appear by 1995-1996, giving users the ability to choose the best parts of various products and incorporate them into their operations. Users will be able to modify and reconfigure applications as dictated by continuously changing business needs.

As usual, the adoption of technology lags behind availability, and it will be the end of the decade before the extent and importance of

these developments to the process manufacturing process become evident.

User Issues and Recommendations

Process manufacturers can receive significant benefits by taking advantage of the products and services currently available from information services providers, rather than developing new applications internally.

Manufacturers that have obtained the highest return on their information services investment, and highest satisfaction as well, have applied the following principles:

- Define objectives and needs carefully, using outside expertise if necessary.

- Insist on industry experience and expertise. Identify three vendors or service providers with industry-specific success. Check customer references.

- Examine the vendor's financial viability. Successful projects are characterized by a long and mutually beneficial relationship between customer and vendor.

- Insist on an open systems approach from the vendor. The vendor should have a credible record in an open system environment.

- Try to keep customized development to a minimum, as custom systems could prove to be very difficult, or expensive, to adapt to changing conditions.

- Carefully define the network environment: Avoid building islands of information.

- Establish benchmarks, based upon current conditions, prior to implementation of a new system.

- When making a change, make it quickly. Make the decision quickly. Implement rapidly. Recognize benefits

quickly. The more rapidly a significant move is made, the higher will be the return.

These user recommendations are summarized in Exhibit VII-1.

Exhibit VII-1

User Recommendations

- Define requirements carefully

- Select proven vendors

- Require truly open systems

- Minimize customization

- Avoid building islands

- Move quickly when making changes

C
Information Services Vendor Issues and Recommendations

The process manufacturing market is huge and fragmented, with no dominant vendor in any segment. The sheer size of this market can be simultaneously inviting and intimidating. Information services vendors who have built significant businesses in this market have followed the principles below:

- Target narrow market segments and strive for segment leadership to assure involvement in a large number of opportunities.

- Develop industry expertise and invest in industry training of sales and support staff. Training is easier in a narrow segment.

- Develop alliances with niche vendors. There are a large number of specialized applications available (customer response systems, for example). Vendors with an open systems approach can take advantage of these applications and invest in improving their own products rather than reinventing old products.

- Develop a sales approach that emphasizes the critical business needs of the customer, rather than the features of the product.

- Train sales people to sell value, not price. Too many vendors with too little money, desperate for sales, are causing price erosion. Some products are becoming commodities.

- Understand the concepts of business process re-engineering, total quality management, and value-added integration.

- Consider ISO-9000 certification for the groups that develop the products and service the customers. Manufacturers expect all their suppliers, with the possible exception of information services providers (because until now there has been no generally accepted certification process), to have formal quality programs in place.

Vendor recommendations are summarized in Exhibit VII-2.

Exhibit VII-2

Vendor Recommendations

- Target narrow market segments
- Develop industry expertise
- Develop alliances with niche vendors
- Focus on customers' critical business needs
- Train sales people to sell value, not price
- Understand BPR, TQM and value-added integration
- Consider ISO-9000 certification

A

Market Forecast Database

Exhibit A-1 on the following page represents the 1994-1999 forecast for the process manufacturing sector.

Exhibit A-1

Process Manufacturing
User Expenditures Forecast
by Product and Service, 1994-1999

Products and Services	1993 ($M)	Growth 93-94 (%)	1994 ($M)	1995 ($M)	1996 ($M)	1997 ($M)	1998 ($M)	1999 ($M)	CAGR 94-99 (%)
Sector Total	7,380	13	8,356	9,496	10,862	12,472	14,338	16,447	15
Professional Services	2,569	14	2,936	3,365	3,861	4,433	5,094	5,856	15
- IS Consulting	644	15	741	852	980	1,127	1,296	1,490	15
- Education & Training	342	5	359	380	403	427	453	480	6
- Software Devmt.	1,583	16	1,836	2,133	2,478	2,879	3,345	3,886	16
Systems Integration	447	13	505	580	675	774	887	1,019	15
- Equipment	172	13	194	222	256	292	334	384	15
- Software Products	44	16	51	59	68	77	89	102	15
- Professional Services	210	12	236	272	320	370	423	486	16
- Other	21	14	24	27	31	35	41	47	14
Outsourcing	954	16	1,107	1,293	1,515	1,777	2,087	2,456	17
- Platform Operations	311	11	345	386	433	485	543	608	12
- Applications Ops.	419	17	490	573	671	785	918	1,074	17
- Desktop Services	120	17	140	165	195	230	271	320	18
- Network Management	104	27	132	169	216	277	355	454	28
Processing Services	789	4	817	842	872	906	930	960	3
- Transaction Process.	789	4	817	842	872	906	930	960	3
Network Services	1,110	15	1,281	1,477	1,719	2,021	2,390	2,780	17
- Electronic Info. Svcs.	941	14	1,069	1,212	1,379	1,583	1,821	2,113	15
- Network Applications	169	25	212	265	340	438	569	667	26
Applications Software	815	16	942	1,097	1,288	1,527	1,810	2,114	18
- Mainframe	197	6	209	220	235	245	257	294	7
- Minicomputer	267	13	301	335	381	426	480	550	13
- Workstation/PC	351	23	432	542	672	856	1,073	1,270	24
Turnkey Systems	696	10	768	842	932	1,034	1,140	1,262	10
- Equipment	331	10	365	395	429	479	523	563	9
- Software Products	252	10	278	308	346	382	423	477	11
- Professional Services	113	11	125	139	157	173	194	222	12
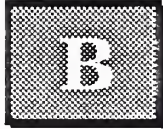
Database Reconciliation

Exhibit B-1 offers the forecast reconciliation for the process manufacturing sector.

Differences between the 1993 and 1994 INPUT forecasts are as follows:

- Based on INPUT's user surveys, the 1993 estimates for professional services were adjusted downwards from $2,738,000 in the 1993 report to $2,569,000 in this report. The 1993-1994 growth and the 1994-1999 growth rates have remained the same as in the 1993 report, but from a smaller base in 1993.

- The 1993 estimates for outsourcing were adjusted based on late recognition of a number of contracts, including two long-term contracts with 1993 impact of more than $100 million.

Exhibit B-1

Process Manufacturing
1994 MAP Database Reconciliation

Products and Services	1993 Market				1998 Market				93-98 CAGR per '93 Rpt.	93-98 CAGR per '94 Rpt.
	1993 Market (F'cst) ($M)	1994 Report (Act.) ($M)	Variance from '93 Forecast ($M)	Variance from '93 Forecast (%)	1993 Market (F'cst) ($M)	1994 Report (Act.) ($M)	Variance from '93 Forecast ($M)	Variance from '93 Forecast (%)	(%)	(%)
Total	7,239	7,380	141	2	13,823	14,338	515	4	14	14
Professional Services	2,662	2,569	-93	-3	5,260	5,094	-166	-3	15	15
Systems Integration	431	447	16	4	849	887	38	4	15	15
Outsourcing	824	954	130	16	1,740	2,087	347	20	16	17
Processing Services	770	789	19	2	890	930	40	4	3	3
Network Services	1,079	1,110	31	3	2,265	2,390	125	6	16	17
Applications Software	793	815	22	3	1,728	1,810	82	5	17	17
Turnkey Systems	680	696	16	2	1,091	1,140	49	4	10	10

C
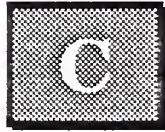
Industry Structure Methodology and Related Reports

This appendix explains INPUT's research methodology and the techniques used in the preparation of forecast data.

A
Industry Structure

Sector Definition - The *process manufacturing* sector, as defined by INPUT, includes:

- Companies that fall within the Standard Industrial Classification (SIC) Codes of 10xx, 12xx, 13xx, 14xx, 20xx, 21xx, 22xx, 24xx, 26xx, 28xx, 29xx, 30xx, 32xx, and 33xx, shown in Exhibit C-1, are defined by INPUT to be in the process manufacturing sector. INPUT's definition also includes some hybrid companies, i.e., companies that incorporate both process and discrete operations to produce their products.

- A process operation is most easily defined by following the form of the material used at the beginning of manufacturing and noting if its form has changed after manufacturing. If the material changes form during production and cannot be uniquely identified in the end product, then a process operation has probably occurred. Additionally, if the input material cannot be brought back to its original form, then a process has occurred to change it. A purely discrete operation, on the other hand, is typically one of assembly.

Exhibit C-1

Process Manufacturing Sector

SIC Code	Description
10xx	Metal mining
12xx	Coal mining
13xx	Oil and gas extraction
14xx	Mining/quarrying nonmetalic minerals
20xx	Food and kindred products
21xx	Tobacco products
22xx	Textile and mill products
24xx	Lumber and wood, except furniture
26xx	Paper and allied products
28xx	Chemicals and allied products
29xx	Petroleum refining and related industries
30xx	Rubber and miscellaneous plastic products
32xx	Stone, clay, glass and concrete products
33xx	Primary metal industries

B
Research Methodology

Research - Much of the data on which this report is based was gathered during 1993 as part of INPUT's ongoing market analysis program. Trends, market sizes and growth rates are based upon INPUT research and in-depth interviews with users in the process manufacturing industry and the information services vendors serving the industry. INPUT maintains ongoing relationships with, and a database of, all users and vendors that it interviews. Interviewees for the research portion of this report were selected from this database of contacts.

INPUT Library - In addition, extensive use was made of INPUT's corporate library located in Mountain View, California. The resources in this library include on-line periodical databases, subscriptions to a broad range of computer and general business periodicals, continually updated files on over 3,000 information

services vendors, and the most up-to-date U.S. Department of Commerce publications on industry statistics.

Financial Data - It must be noted that vendors may be unwilling to provide detailed revenue breakouts by product and service or industry. Also, vendors often use different categories of industries and industry segments or view their services as falling into different product and service categories from those used by INPUT. Thus, INPUT must estimate revenues for these categories on a best-effort basis. For this reason, the product and service individual segment forecasts should be viewed as indicators of general patterns and trends rather than specific, detailed estimates for specific years.

Rounding - When displaying market forecast values in bar and column charts, INPUT rounds these amounts for ease of visual reference. Markets of $1 billion or more are rounded to the nearest $50 million; $100 million to $999 million to the nearest $10 million; and $50 to $99 million to the nearest $5 million. Actual values are shown in charts for markets of $49 million or less, in Appendix A and Appendix B tables, and in chapter text.

C
Related INPUT Reports

The following INPUT reports may also be of interest to the reader:

- *U.S. Discrete Manufacturing Market, 1994-1999*

- *U.S. Application Solutions Market, 1993-1998*

- *U.S. Network Services Market, 1994-1999*

- *Software Product/Support Strategies, 1994*

- *U.S. Systems Integration/Professional Services Market, 1994-1999*

- *Business Process Re-engineering—Impact on Systems Integration*

- *U.S. Outsourcing Market, 1994-1999*

- *U.S. EDI/Electronic Commerce Markets, 1993-1998*